CALIFORNIA
OIL WORLD
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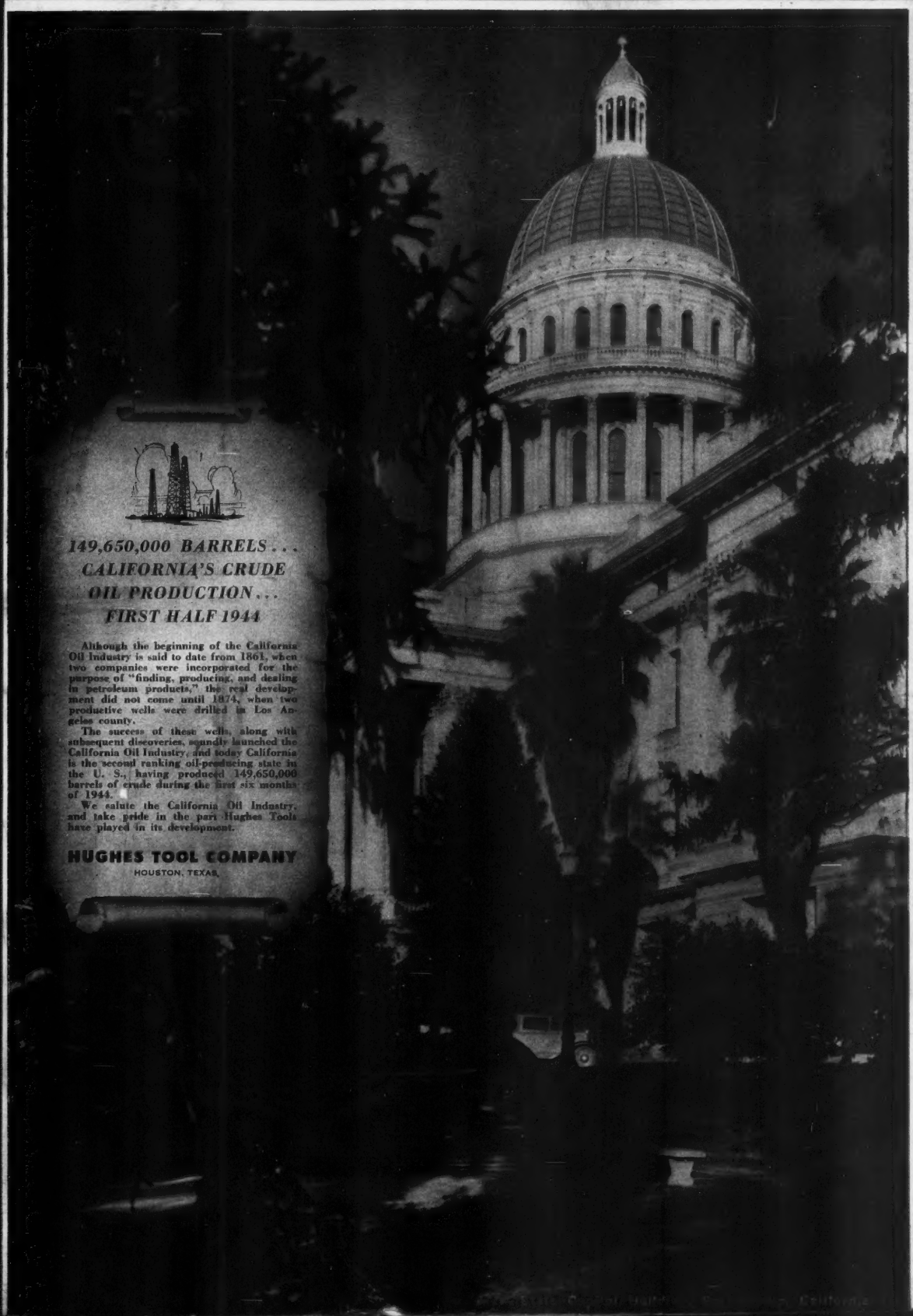
149,650,000 BARRELS . . .
CALIFORNIA'S CRUDE
OIL PRODUCTION . . .
FIRST HALF 1944
Although the beginning of the California Oil Industry is said to date from 1861, when two companies were incorporated for the purpose of "finding, producing, and dealing in petroleum products," the real development did not come until 1874, when two productive wells were drilled in Los Angeles county.
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TWICE MONTHLY
FIRST ISSUE
OCTOBER, 1944

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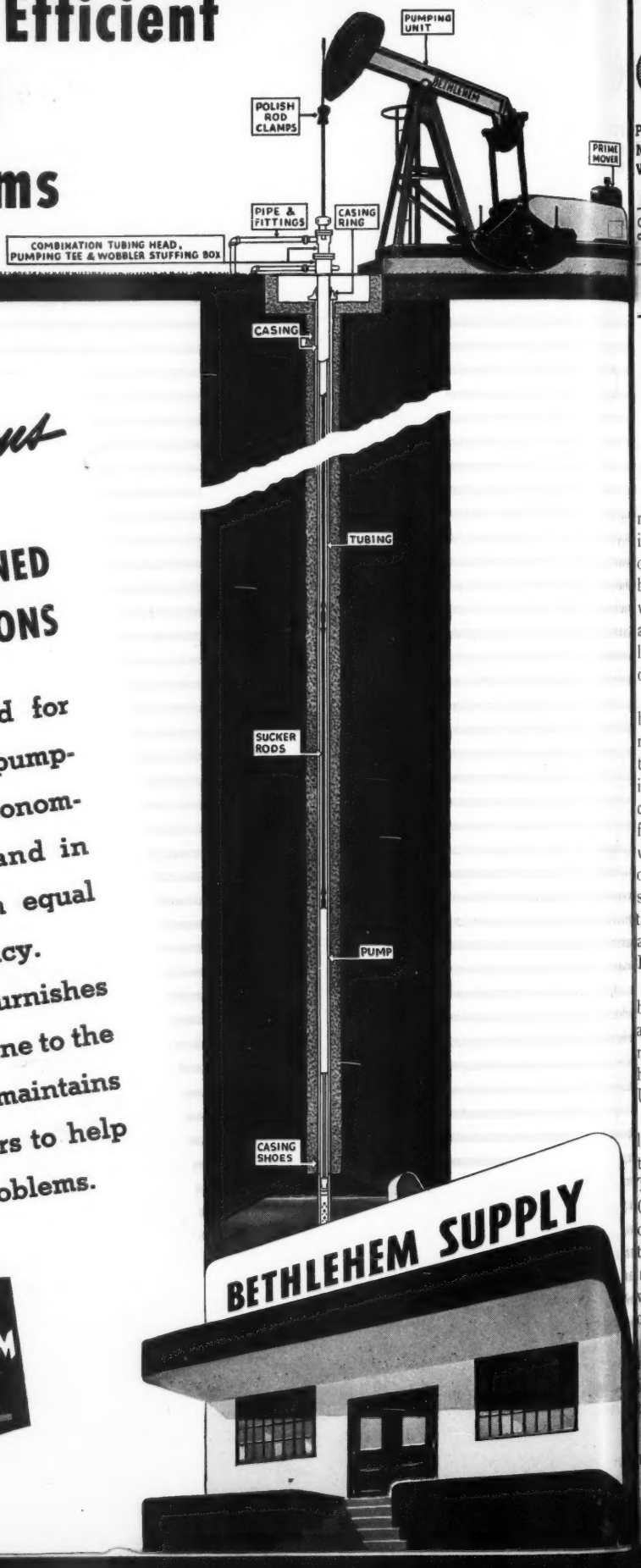

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CALIFORNIA
OIL WORLD

PUBLISHED TWICE A MONTH
FOR TIMELY, COMPLETE
CALIFORNIA OIL NEWS COVERAGE

• FIRST ISSUE
OCTOBER, 1944
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KINZIE MILLER—Vice President

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October 14th, 1944
Telephone Number TUcker 2571

Carrington Kling

Before the oil industry—like other major U. S. industries—gets too gay in its postwar thinking, let's tune in on some of the predictions that are being made in Washington by those whose job it is to plan, as best they are able, for a comparatively painless readjustment to peacetime conditions and resumption of trade.

Although the entire country has been sobered by recent developments in Europe and the realization the Battle of Germany may drag out into a grim winter campaign, officials here are redoubling their efforts to present the industry with a workable postwar program that not only will point the way for the resumption of normal domestic operations but will dovetail with the needs and plans of our Allies when the European war is ended.

Daily conferences are in progress between the various Government agencies interested in petroleum matters and daily discussions are held with representatives of the United Nations.

Leading the fight for a streamlined postwar oil program is the Petroleum Administration for War. This "rugged individualist" among Government agencies is in the midst of a campaign to slash the red-tape that spirals from its sister-agencies and to speed up the machinery that will be needed to create an effective overall postwar program.

While PAW already is whittling itself down to a size more compatible to the reduction in its functions that will be possible immediately following a general peace (it is now running almost $1,000,000 below its approved appropriation and has reduced its personnel by approximately 15%), there is little likelihood that the end of the war in Europe will see any startling change in the present set-up, CALIFORNIA OIL WORLD was told.

There has been some talk of the possible liquidation of all PAW District offices,—with the exception of District 5, which must go on producing for the Japanese war. This, according to Deputy Petroleum Administrator Ralph K. Davies, would be unfeasible as the Pacific Coast district cannot be expected to carry the burden alone. Presumably, it will take "some of the same forces and some of the same machinery" involved in the present five-district set-up to insure adequate supplies for the Pacific offensive, the California oil executive said.

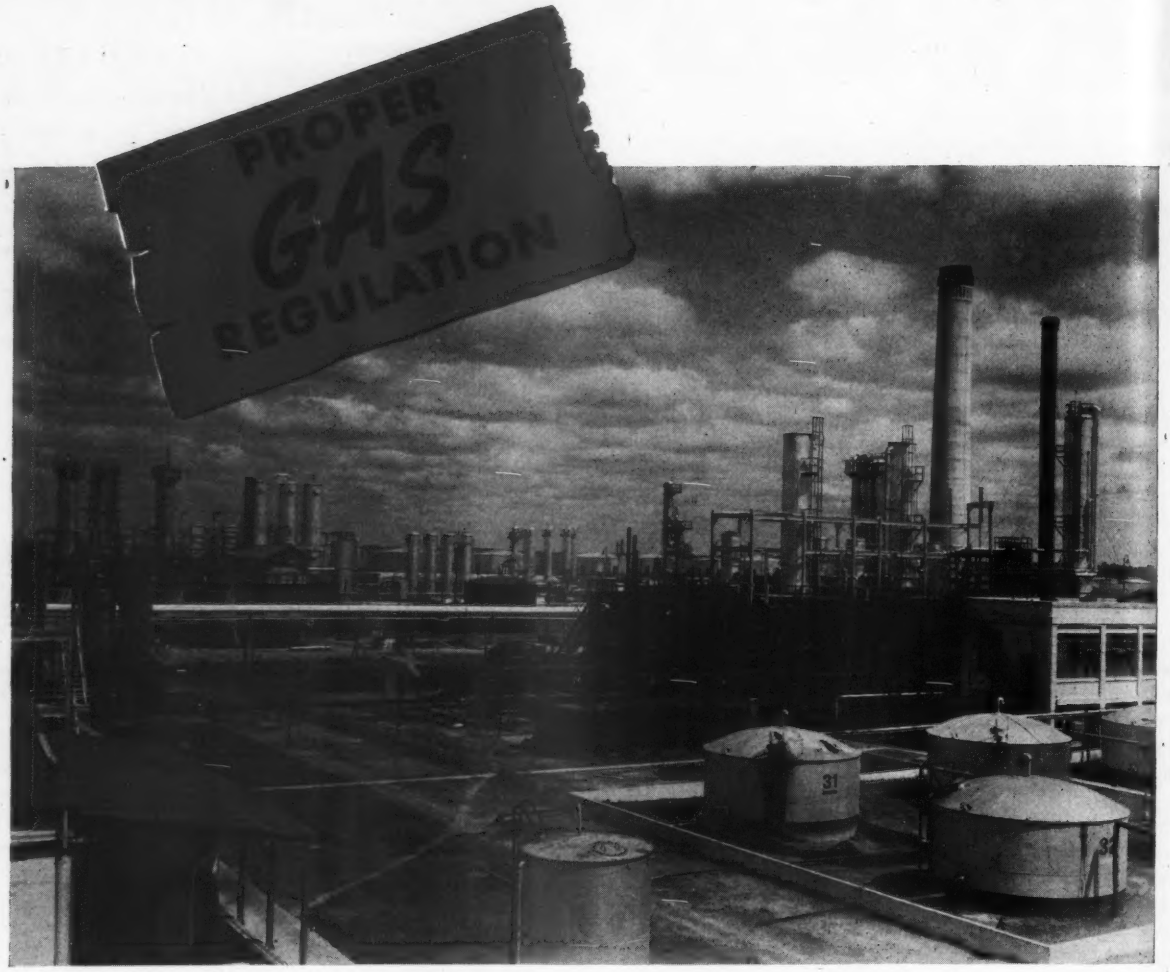
Davies conceded, however, that there may be changes in the districts outside the Pacific Coast area, such as a reduction of existing forces to skeleton proportions and a consolidation of the functions of the districts East of the Rockies. In this connection, he said, District 4 might be consolidated and divided up between Districts 2 and 3,—although definite plans have not yet been made.

California companies with considerable oil in storage had best resign themselves to the fact that military authorities already have earmarked this surplus storage for use in the war against Japan. Although Pacific Coast oil stocks are not abnormally high, the military is likely to draw first upon whatever California oil is available before importing petroleum products from other parts of the country.

The PAW recognizes the fact that California production is high and that some pools in the State are producing above their MER's. In instances where damage is occurring to a pool, and where the cost resulting from this damage exceeds the cost of running oil in from the outside, PAW will "do the things that's cheapest", this writer was told. Rather than let California operators overproduce to a dangerous degree, the Government will move oil in from Texas or the Caribbean, it was stated.

As this is being written, Ralph Davies and other PAW officials are in New York for an important conference with the railroads. The purpose of the discussions is the movement of 40,000 barrels daily of Texas sour crude into California by rail,—providing the railroads agree to trim their rates and providing the Reconstrucion Finance Corp. agrees to foot the bill, as it has been doing in the East. Secretary of Commerce Jesse H. Jones is said to favor the plan.

Another important straw in the wind is the joint application of Pacific Gas & Electric Co. and Southern California Edison Co. for a 27½ inch pipeline to pipe gas from the Texas Panhandle into the Los An-



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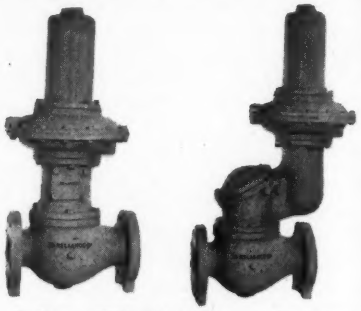

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geles area. The application has been filed with the Federal Power Commission and the Office of War Utilities and is said to involve an investment of $50,000,000,—with the California utilities putting up the cash.

This is a matter in which the California oil companies have a very considerable interest and, if their attorneys are not working on the subject already, it will be necessary to muster all the legal talent available for the fight ahead. For if the gas line is not wanted, it will be up to its opponents to prove that it is not needed,—and some people believe this may be a difficult job. There seems to exist some doubt that the Southern California utilities will be able to get along after the war without additional supplies of gas.

One of the most important developments of the past few weeks was the establishment, Oct. 2, of a new "key committee", headed by Ralph Davies and staffed by representatives of PAW, the Foreign Economics Administration, the War Production Board, the State Department, the joint Army and Navy Petroleum Board and the War Shipping Administration. Davies is chairman of the new group, and Claude P. Parsons, director of PAW's Materials Division, vice-chairman.

The Foreign Petroleum Requirements Committee will play an important part in speeding the flow of drilling and refinery materials overseas and in simplifying the procedure under which foreign operators must work if they are to go ahead with urgent programs of production and rehabilitation.

Working in accord with the new Priorities Regulation No. 9, this group will strive to smooth out the difficulties now encountered by companies anxious to begin or resume production and refining operations abroad. Considerable dissatisfaction already has arisen among companies with foreign interests, and among the British, over the delays and red-tape encountered in acquiring needed materials, it is understood.

This project is being aggressively pushed by PAW and, according to Deputy Administrator Davies, PAW intends to "force some action" in the near future. The plan is "heartily supported" by the State Department, Davies said.

Consideration of the International Petroleum Agreement — drawn up this summer by the United States and British Governments but temporarily bogged down awaiting the outcome of the November elections —is now being undertaken by the Committee on National Oil Policy of the Petroleum Industry War Council, — with indications that a more tolerant view may be taken of this effort to pave the way for international harmony in oil matters, although some revisions may be expected. The agreement probably will come up for discussion at the October PIWC meeting in a more kindly light than in previous sessions. . . .

Appointment of Alfred Jacobsen, president of the Amerada Petroleum Corp., as chairman of the Oil Policy Committee, was one of several changes in committee chairmanships and assignments announced by PIWC. B. Brewster Jennings, new president of Socony-Vacuum Oil Co., Inc., and Dr. Joseph E. Pogue, vice-president of the Chase National Bank, were named as members of the policy committee and Jennings also was appointed a member of PIWC's committees on Petroleum Economics and Renegotiation.

W. Alton Jones, president of Cities Service, stepped down as chairman of the Supply and Transportation Committee of District 1—although remaining a member of the group—and B. I. Graves, vice-president of Tide Water Associated Oil Co. took over the chairmanship. Jones, who succeeded the late John A. Brown as chairman of the General Committee of District 1, was named a member of the Petroleum Economics Committee.

With the national elections coming ever closer, the usual political bickerings have arisen within the oil industry. Senator Clyde M. Reed (R., Kans.) made the front pages with a demand that the value of A-coupons for gasoline be doubled; Robert E. Hannegan, chairman of the Democratic National Committee, warned the country that, if Dewey were elected, Joseph N. Pew, Jr., Philadelphia oil tycoon, would "become one of the dominating figures behind the United States Government;" Ed Pauley, treasurer of the Democratic National Committee, was accused of a plot to form a syndicate in California to acquire leases in the tidelands area. . . .

Another well-publicized yelp was that of Senator Guy M. Gillette (D., Ia.) who bitterly complained the synthetic rubber-from-alcohol program was being robbed by the rubber-from-petroleum industry and muttered darkly that the oil companies were getting ready to dominate the synthetic rubber picture after the war. This accusation was termed utterly without foundation by PAW, which pointed out Gillette undoubtedly was referring to the "loan" of a considerable amount of butylenes — requested some time back of the manufacturers of rubber from grain products in order that a sudden expansion of the 100 octane program could be made possible. The butylenes have since been returned to the lenders, PAW observed.

The Reed incident fizzled out after the Kansas Senator had claimed that "a man who attended a conference" held by Office of Defense Transportation Director J. Monroe Johnson had wired him that it was brought out at the conference that an additional 300,000 B/D of motor gasoline was available for civilian use. Col. Johnson issued a statement saying the report was "without the slightest foundation in fact", pointing out that PAW's allocation for the fourth quarter actually was less than the quantity ODT had asked for. . . . The story did not fade from the newspapers, however, until Reed and Petroleum Administrator Ickes had engaged in a brief, verbal fisticuffs,—with Ickes terming Reed's statement "thoroughly mischievous" and Reed retorting that Ickes ". . . didn't attack my figures, did he? They were plain statements of fact. Apparently it is congenitally impossible for Mr. Ickes to be a gentleman."

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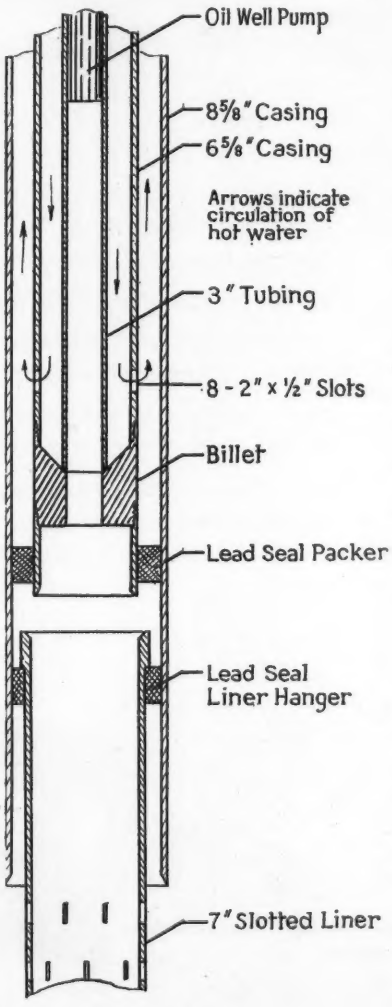
Hot Water Circulation Facilitates Production of Heavy Oil

There are a few areas in California where the crude produced is heavier than water; but the heaviest is probably at Oxnard where the oil has a gravity of approximately 6.5 degrees. Such oil does not flow easily at normal temperatures. The lifting of this viscous oil to the surface presents a problem; but its storage and transportation offer further difficulties. Heavy oil, however, is in particular demand at the present time because the construction of air fields, military roads and similar projects requires great quantities of asphalt. Its maximum production is thus highly desirable. Equipment for producing and handling heavy oil with greater efficiency and without dilution has been designed by Claude L. Cole, manager of production and drilling for Exeter Oil Company, Ltd., and has recently been installed in that company's well, Lenox No. 2, at Oxnard. The use of this equipment has resulted not only in greater efficiency and economy in production but also in the delivery of a better raw product for processing at the refinery.

Since this extremely heavy oil is unpumpable at the temperatures obtaining in the wells from which it is produced and will not flow freely at atmospheric temperatures when brought to the surface, some means has to be taken to lower the viscosity during production and while handling the oil until it is turned over to the refinery. Production in the other wells in the Oxnard area is rendered pumpable by the injection of gas oil into the well and then lifting this mixture to the surface. The amount of gas oil employed in this method averages from 10 to 12 per cent and the actual gravity of the heavy oil being produced is not known. When the mixture of crude and gas oil reaches the surface, it is heated to a temperature of approximately 175° in order to ship it to its destination. If heated above this temperature it has been found to foam.

The method being used in the Exeter well requires no thinning agent of any kind. As indicated in Fig. 1, hot water is circulated down the well without coming in contact with the crude, and production is kept in a condition that is easily handled by the oil well pump. Upon reaching the surface the temperature of the oil is maintained at a temperature necessary for its handling and transportation by hot water coils and jacketed lines until it is loaded into trucks which carry it to the refinery.

The present production of the well is 380 bbl. per day with less than 1 per cent water. The well was completed at 2812 ft. with a 13⅝-in. surface string cemented at 160 ft. and a string of 8⅝-in. casing cemented at 2480 feet. A slotted liner (16 rows, 187 mesh, 6-in. centers) was then run in and hung on a lead seal liner hanger with top at 2472 feet.



As can be seen in Fig. 1, circulation of hot water in the well is provided by a string of 6⅝-in. casing run in the 8⅝-in. string and so sealed off that the water passes down the annulus between the tubing and 6⅝-in. casing and up between the 6⅝-in. and 8⅝-in. strings. The 6⅝-in. casing is equipped with a lead seal packer on bottom and this packer was set just above the lead seal liner hanger. Above the packer is a cylindrical billet that had been milled out to form a beveled top above a hole through the billet, which hole was made with a diameter the same as the I. D. of the 3-in. tubing to be used for producing the well. The billet was constructed with a female thread at top and male thread at bottom. Just above the billet eight 2" x ½" slots in the 6⅝-in. casing provide for passage of the hot water from the inside to the outside of this string. After the packer had been set, a string of 3-in. tubing with a lead-faced bevel on bottom was run into the well and seated on the upper beveled face of the billet.

Water at a temperature of 265° F. is circulated continuously down the annulus between the tubing and the 6⅝-in. casing, through the slots in this casing and up between it and the 8⅝-in. string, as shown in the drawing. The temperature of the water upon its return to the surface has been found to be consistently at 235° F. The temperature of the oil upon reaching the top of the well is found to be the same as the water at its discharge. The hot water circulation heats the oil in the well, thus keeping the viscosity down and providing for easy pumping.

A centrifugal pump, powered by a 7½ hp. electric motor, circulates the hot water in the well at a rate of 130 g.p.m. The suction line of the pump is 3-in. and the discharge 2½-in. A pressure of 10 p.s.i. is carried on the suction intake and

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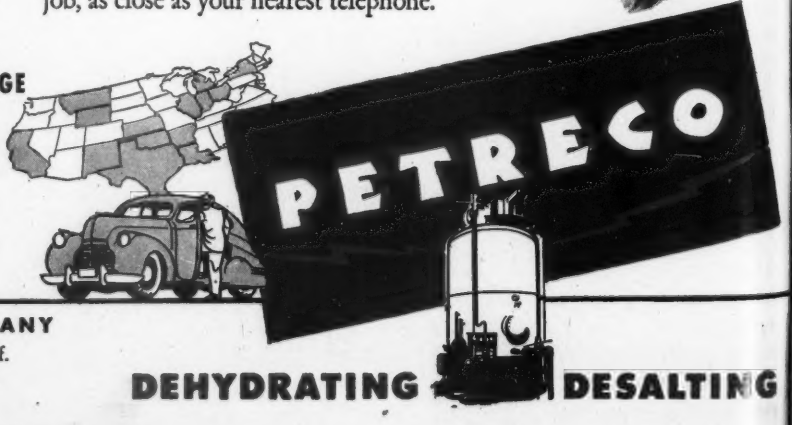

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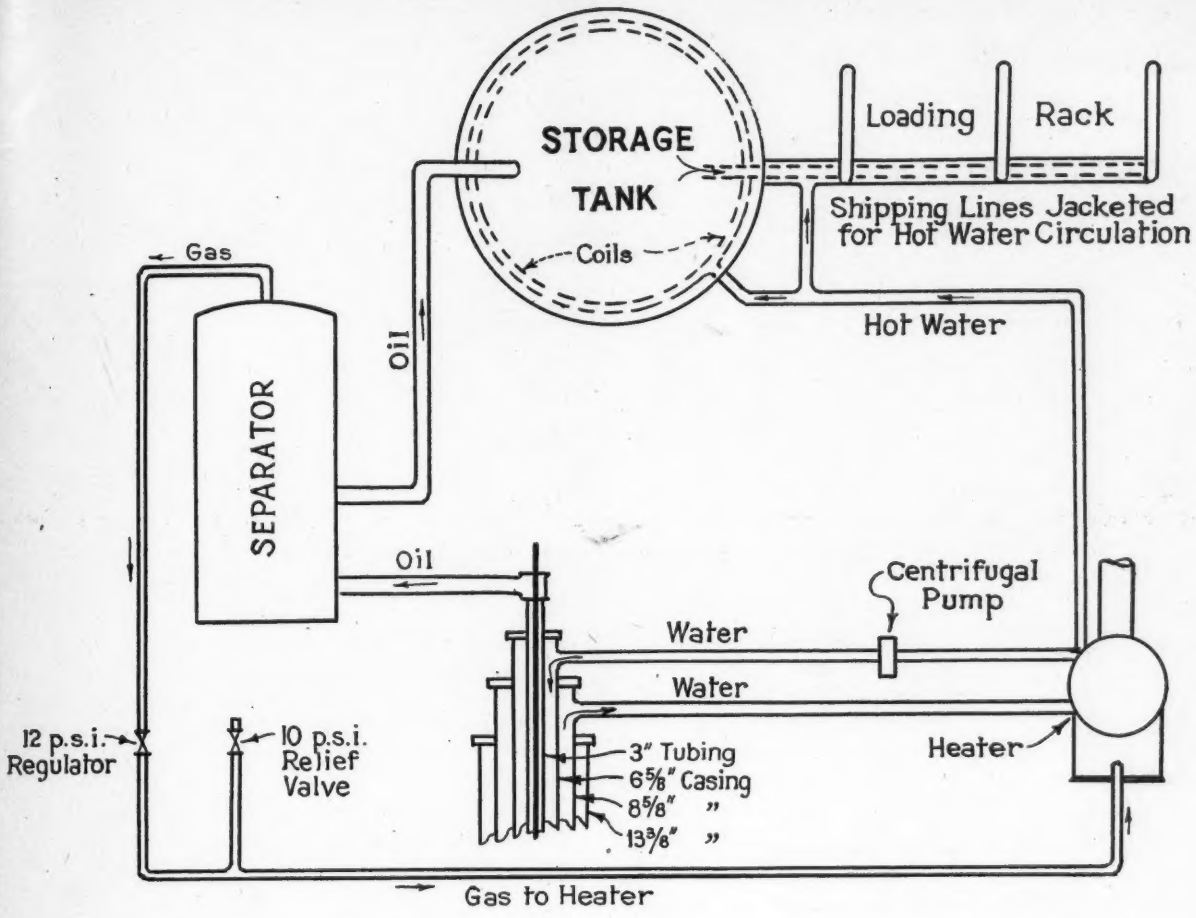

the water is discharged at a pressure of 60 p.s.i.

An old 85-hp oil field boiler was converted into a hot water heater and this furnishes the hot water for circulation in the well and for maintaining heat of the crude until it is loaded into trucks. The heater is larger than necessary but since it was available for use and other equipment could not be obtained it has served the purpose adequately. Gas taken from the oil is being used for fuel. When the heating equipment was first installed the gas was not separated from the oil and the crude itself was used to fire the heater.

The use of the separator has proved advantageous in more ways than one. Before it was installed the gravity of the oil in the storage tank ranged between 6.2° and 6.4° A.P.I. After the gas trap was put in service and the gas taken off, the gravity of the oil increased 6.8° A.P.I. The gas is being removed under a pressure of 12 p.s.i. and is thus not allowed to pass off freely at atmospheric pressure and carry the condensates with it. By keeping the condensates in the oil the gravity is increased. The separator is of the conventional type with kidney-valve liquid level control but is equipped with heat coils to aid in maintaining the temperature of the oil during its passage to storage.

The oil passes from the separator to the storage tank which is equipped with hot water coils placed within the tank and close to its perimeter. The temperature of the oil is here kept at approximately 215° F. The oil is taken from the tank to the loading rack where it is loaded into trucks. The line carrying the oil to the loading rack takes the oil from a point three feet in from the wall of the tank in order to obtain oil of an average temperature.

Oil from this well is trucked to the company's refinery at Long Beach, a distance of 80 miles. All shipping lines, including the line from the tank to the loading rack, are jacketed for hot water circulation and the oil is put into the trucks at a temperature of 215° F. It takes approximately three hours to haul the oil from the well to the refinery and it has been found that the heat loss during the trip is less than 30° F. This insures the delivery of an easily-handled oil. The temperature at which the oil is loaded is higher than can be used for a mixture of crude and gas oil and evidently provides a desirable factor of safety when unexpected delays occur en route. As an example, one truck was once unavoidably delayed for considerably more than half a day; but the oil was in such condition when it reached the refinery that it could be unloaded.

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Hence, it's nice to know the public approves them—despite their wartime handicaps. It's a condition, not a theory, that motorists must get along on little so that the military services may have much. And our "front men" serve the very people who must accept these shortages.

Nevertheless, the letters show appreciation and understanding. Best of all, they appraise at high worth those extra efforts our salesmen make to stretch existing supplies into extra civilian miles. To the rest of us, that's inspiring—a sort of "E" flag from the public.

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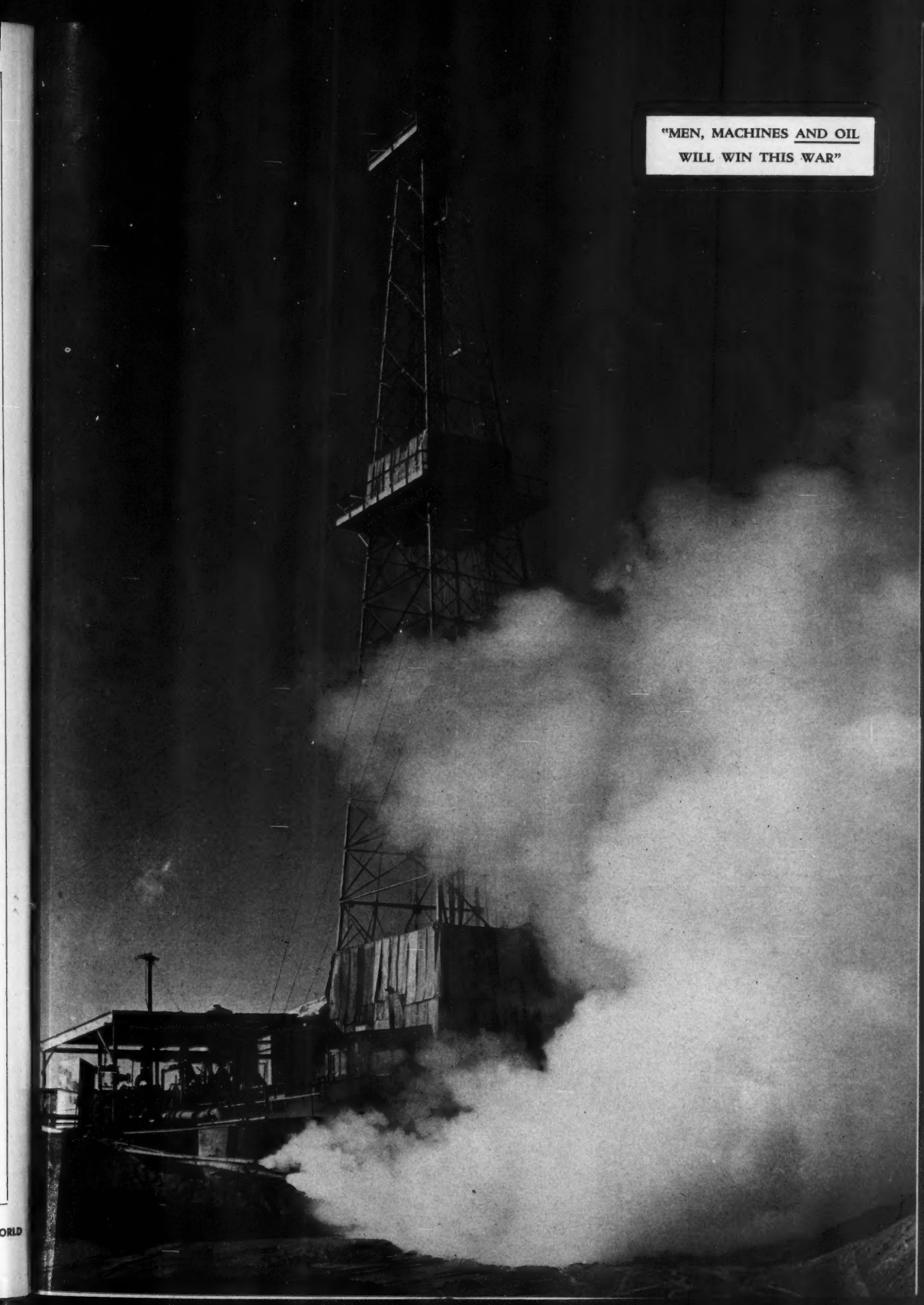
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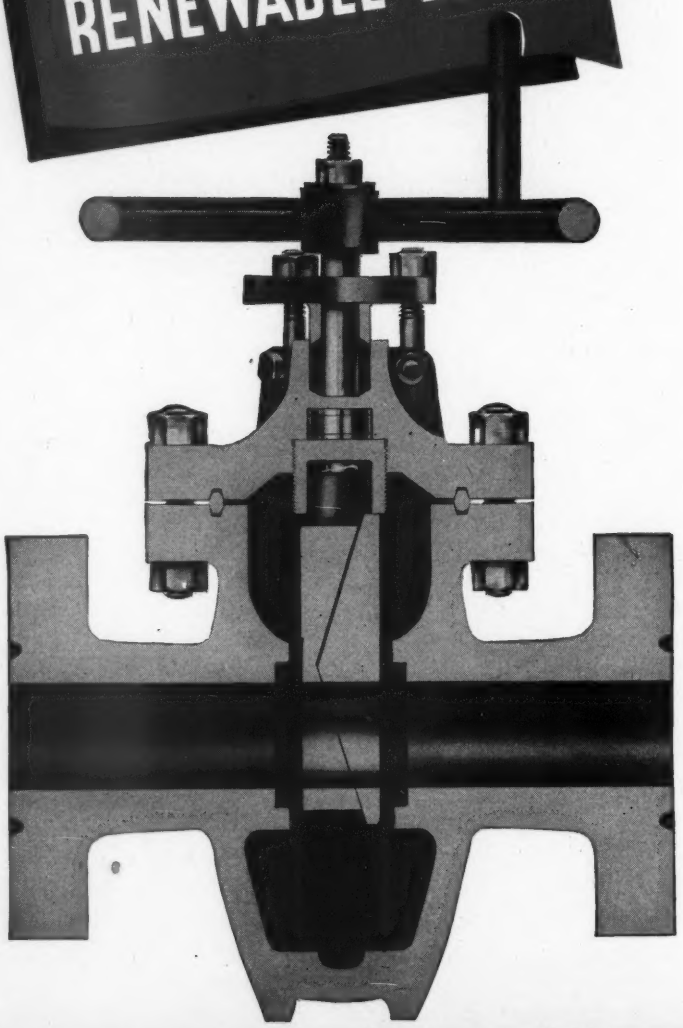

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Secondary Recovery By SELECTIVE COMPLETION

By WARREN J. JACKSON

In many fields subjected to secondary recovery the gun perforator is providing the most effective means of injecting gas or water into the producing zone. Efficiency of secondary-recovery operations depends upon proper use of reservoir data and the application of improved completion methods.

The subsurface arrangement of casing and tubing in wells employed to increase the ultimate recovery of oil from a reservoir by secondary recovery methods has been studied in much detail in order to secure the most efficient installation possible. Methods of production utilizing the return of gas or water to the producing formations for gas-repressuring or water-flooding operations have proved beneficial to the extent that oil production from the sands has exceeded the normal expectancy by primary production methods. There are intricate problems involved in secondary recovery; but the experience gained, together with the results that have been obtained in both old and new fields, has caused production engineers to study these problems and to put into effect present-day methods of completion to improve the efficiency of this important phase of production.

When fields were first subjected to secondary recovery operations the information available was quite meager for intelligent study; the operator was dependent upon general well data consisting primarily of drillers' logs and whatever happened to be known about sand thickness, relative porosity and saturation. Other information available was stratigraphy of the area together with other geological information such as the structural conditions of the field and the producing formations in the wells. It was not until after the final completion of individual wells that any basis was formulated upon which to ascertain the relative productivity of a well.

In some fields the injection of gas or water back into the reservoirs has had a limited effect in increasing the oil production. A general review of the subsurface conditions in these fields revealed certain conditions in the producing formation itself, as well as of the type of subsurface well settings being used, which accounted for the results obtained. There were many factors involved, but the one most contributing was the lack of information regarding the productive characteristics of the oil and gas zones of the producing and injection wells; and due to the casing setting used, there was very little, if any, control over the productive zones into which the injected gas or water would enter.

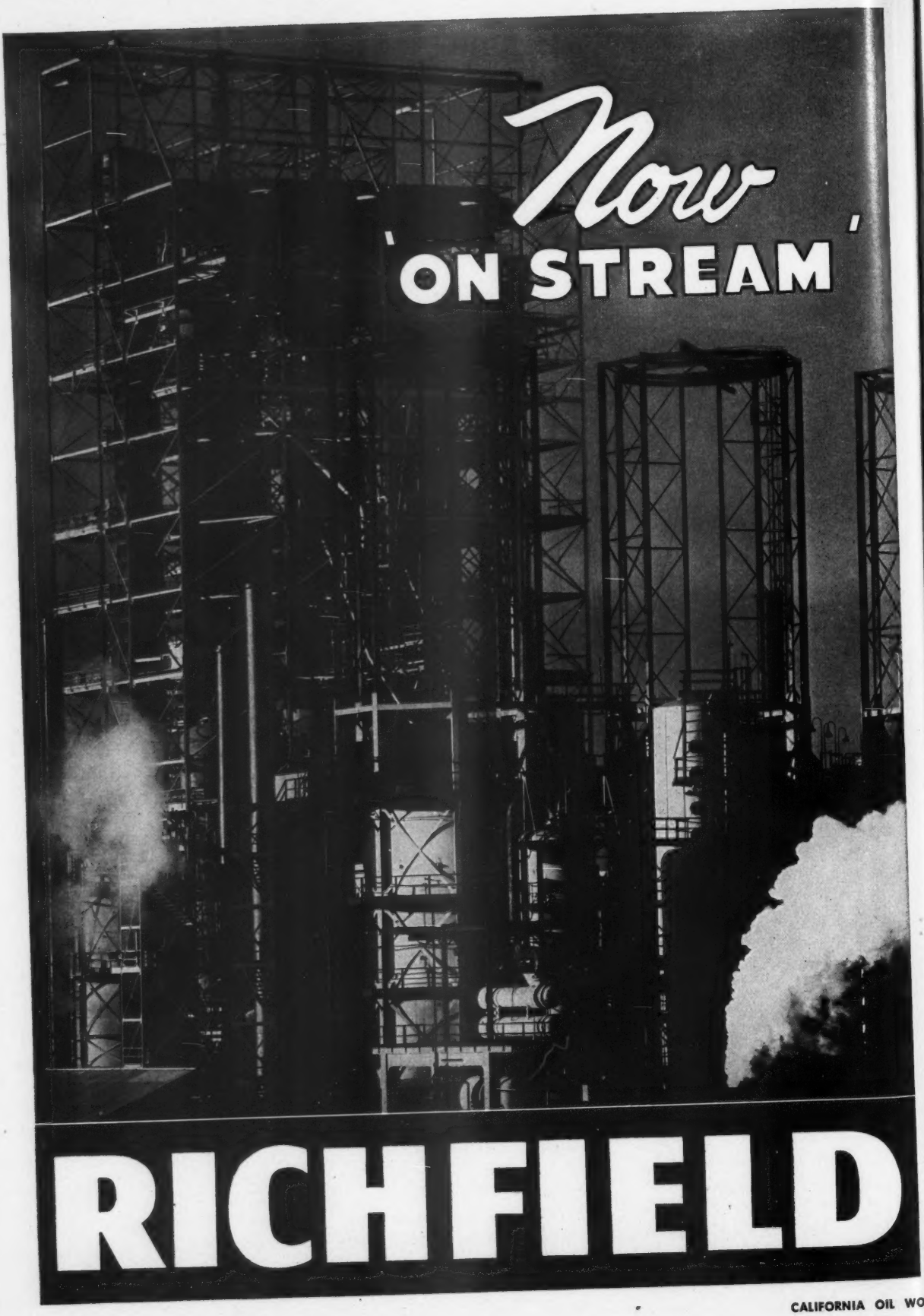
The advent of improved present-day methods of drilling and completion and the use of new means of analyzing subsurface reservoir data have aided immeasurably in developing more effective methods for employment in secondary recovery. Experience in many fields has dictated the importance, not only of injection at the surface, but also of flow into the individual zones themselves. By selective completion of the wells, the entire reservoir is permeated uniformly and the oil is displaced gradually and slowly from the injection wells with uniform effectiveness.

Reservoir Characteristics

The basis for primary or secondary recovery methods of producing any oil and gas reservoir will, of course, depend upon the type of reservoir from which this oil is being produced; that is, whether its movement of fluid in the sand has been by gas expansion or water drive, or by a combination of both. This condition is all important when considering the characteristics of a reservoir for secondary recovery operations, and is of primary importance in the design of a well pattern for the return of a repressuring agent to the producing formation.

It has been recognized that the two most important characteristics of a reservoir formation are its porosity and permeability. The determination of these factors from core analysis at the time of well completion is of immeasurable service in the valuation of the reservoir and serves as an index to proper completion and operation methods.

The porosity and permeability of oil producing formations have wide variations. This being in evidence in the same sand or lime penetrated by a well, the porosity may vary from less than five per cent to more than 30 per cent and the permeability from less than 100 millidarcys to several darcys. In many fields, after the pri-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'ON STREAM'
RICHFIELD

mary production of the reservoir has been obtained, much of the oil will have been produced from those sections in the pay zone having the greatest permeability and much of the additional recoverable oil yet to be produced by secondary methods will be in the sections of the lower permeability.

When evaluating the permeability of the pay zone in its ability to permit movement of fluids, it is obvious that the same relationship will necessarily exist for the reverse operation wherein gas or water is returned to the pay zone. Taking into account other factors, such as the saturation gas volume, formation volume factor, oil viscosity and exposed formation thickness, the relative capacity of the oil zones to produce fluid under a given rate and differential pressure can be estimated fairly accurately. On this same basis the completion of the well by selective completion opposite pay zones would facilitate the injection of the gas or water into these zones in relationship to their respective permeabilities, and at predetermined rates, in order to obtain full benefit of such operation and to make it more effective in securing an even greater ultimate recovery.

Figure 1 is shown to illustrate an oil saturation, porosity and permeability profile of cores recovered from a well drilled for injection purposes. The field in which the well was located had been producing oil over a period of several years. It will be noted that there is a considerable variation of permeability from one section to another in the same producing zone and also some slight differences in the saturation and porosity values. These factors must all be taken into account when making a proper completion of the well for injection.

Casing Settings

The location and selection of injection wells having been made, the arrangement and type of setting best suited will depend upon the permeability profile. Taking this factor into account, the design of the casing setting is made on the basis of the selectivity of the pay sections into which the repressuring agent is to be injected. This is accomplished by setting the casing through the entire producing formation and, after cementing, completing the productive zones by gun-perforating. By differentiation of the sections of equal permeabilities, subsequent injection or the return of the repressuring medium can be regulated. By subsurface correlation of the wells with respect to producing sections, observation of the results can be ascertained. Unless such steps are taken in the preparation of wells for repressuring, channeling will often occur between the injection wells and the producing wells, with no apparent increase in production. The project is then frequently declared a failure.

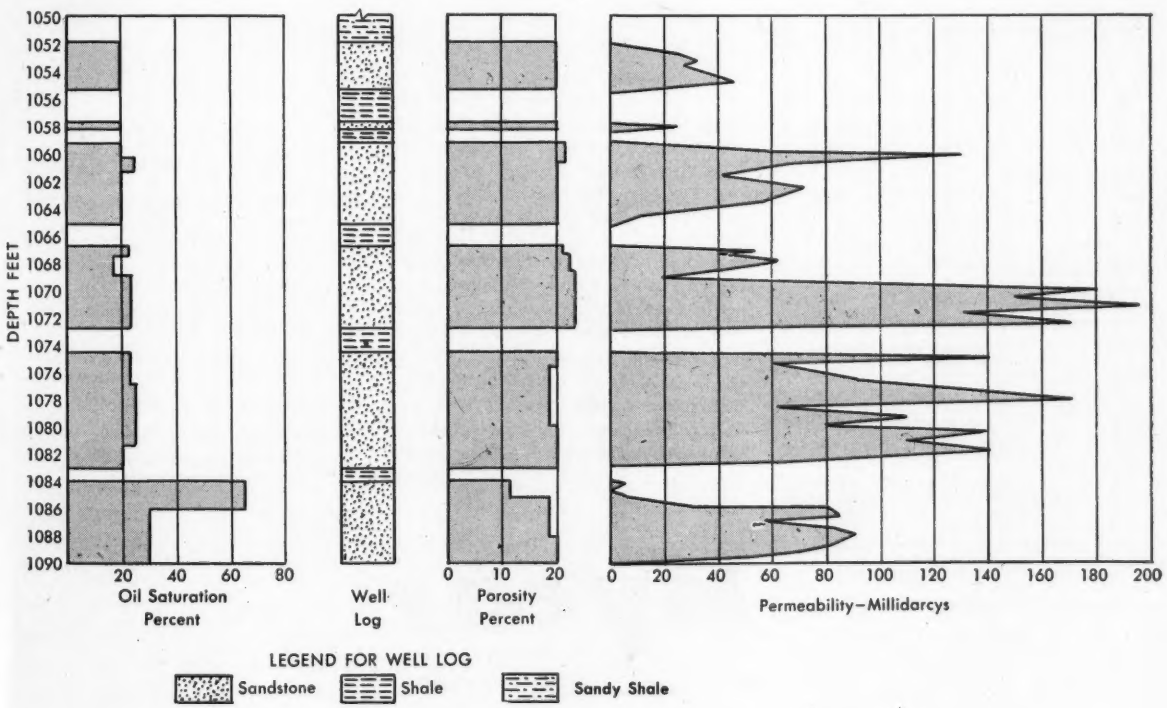
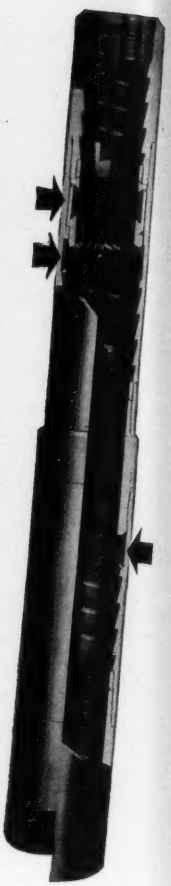


Figure 1

Photographs courtesy of Bowen Co. of Texas, Inc.



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HYCAR pack-offs *perform* in Bowen overshots

THE arrows in the picture to the right show the location of Hycar pack-off rubbers in the Bowen Series 200 Drill Pipe Overshot. Hycar was selected for this application because it was possible to get the right combination of properties essential for this particular service.

The requirements of this service are well known to every oil man—resistance to oil and gas, resistance to a number of different acids, resistance to high temperatures, plus the ability to stay resilient and provide a positive seal. Hycar meets them all.

And Hycar does a lot more. Look at the list in the box at the right. Note the number of properties for which there is a specific need in oil field applications. Hycar's ability to provide the right combination of these properties has established it as a truly superior product for oil field use. Gate packers in mud line valves, oil well tubing packers, gaskets, hose—these are just a few of the products that require Hycar's unusual qualities.

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WHAT HYCAR DOES IN OIL FIELD APPLICATIONS

1. Resists oil and gas—even under high pressure.
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3. Wears at slow rate even under worst conditions.
4. Makes a positive, leak-proof seal, even after a long period of service.
5. Provides high elasticity.
6. Gives high tensile strength.
7. Has minimum tendency to cold flow and compression set.

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Figure 2

Figure 3

Figure 4

In Figures 2, 3, and 4 are given cross-sectional views of three typical wells. Two of these wells are oil producers and the other is an injection well. After analyzing the reservoir and core data available, casing, liner and tubing settings were devised as illustrated. A packer was installed in the annulus between the casing and tubing of the injection well to facilitate the regulation of pressures and volumes into the oil zones.

Figure 5 shows an injection well setting in which the casing was run through the upper sand and set on top of the lower sand where it was cemented. The upper sand was gun-perforated and a packer set in the interval between the two sands. In the original operation of this well on injection, no packer was installed; so the same pressure and volume were applied to the face of both sands. It was soon observed, however, that excess channeling of the gas to the producing wells nearby was taking place through one of the two sands and this necessitated the packer installation to remedy this condition. Later information obtained on the sands revealed that the permeability and productivity of the two sands were quite dissimilar, and that the arbitrary pressure and volume injected originally was in excess of the pressure and volume required in the upper sand. Results later proved this sand to be the one through which channeling had occurred originally. Through the use of this type of setting, simultaneous injection of gas at individual pressures and volumes into each sand are regulated in accordance with the characteristics of each sand and are consistent with the results obtained in increasing the oil production of the surrounding wells.

It is quite obvious that in many fields it is not always economical or practical to equip old wells for injection purposes in the manner described here. In other fields it has been found more satisfactory as well as more profitable to drill new wells for injection purposes.

The selective completion by gun-perforating of injection wells will increase the life and usefulness of these wells because, when any one of the producing sections of the oil zones immediately surrounding the wells has been depleted of its recoverable oil, this section can be squeezed off by cementing and the injection continued in other sections. The conversion of a producing well, or the drilling of a

new well for injection purposes, represents a large investment; and the ultimate results obtained in increased production will necessarily depend upon the cost of obtaining this production. Unfortunately, in many old fields such practices of well completion were not available at the time these fields were placed on secondary recovery. However, it has been observed that in many cases (and it is being done at the present time) that these properties can be made to produce even greater amounts of oil than were obtained previously, by recompletion of the wells with selective completion methods.

The present reserve of recoverable oil yet to be recovered by secondary-recovery methods has been estimated to be in excess of three billion barrels. It is the opinion of a great number of operators and engineers that in many fields the ultimate recoveries can be increased to as high as 90 per cent of the original estimated oil in place in the sands by utilizing the present-day methods of reservoir control in the primary production stage of a field and then following this by a well-designed pattern of subjecting the field to secondary-recovery operations.

The amount of oil to be recovered from a given field has been found to depend to a large extent upon the method of production and the application of present completion techniques. One of the chief difficulties in any gas-repressuring or water-flood project has been channeling from the injection well to the producing wells and a consequent loss of recoverable oil. This is sometimes avoided temporarily by balancing withdrawal rates, drilling new wells, holding back pressure on the producing wells, and regulating the surface injection of gas or water.

The efficiency of oil recovery by secondary-recovery methods, and the prevention of underground losses, can be brought about only by the proper use of reservoir data and the utiliza-

(Continued on Page 64)

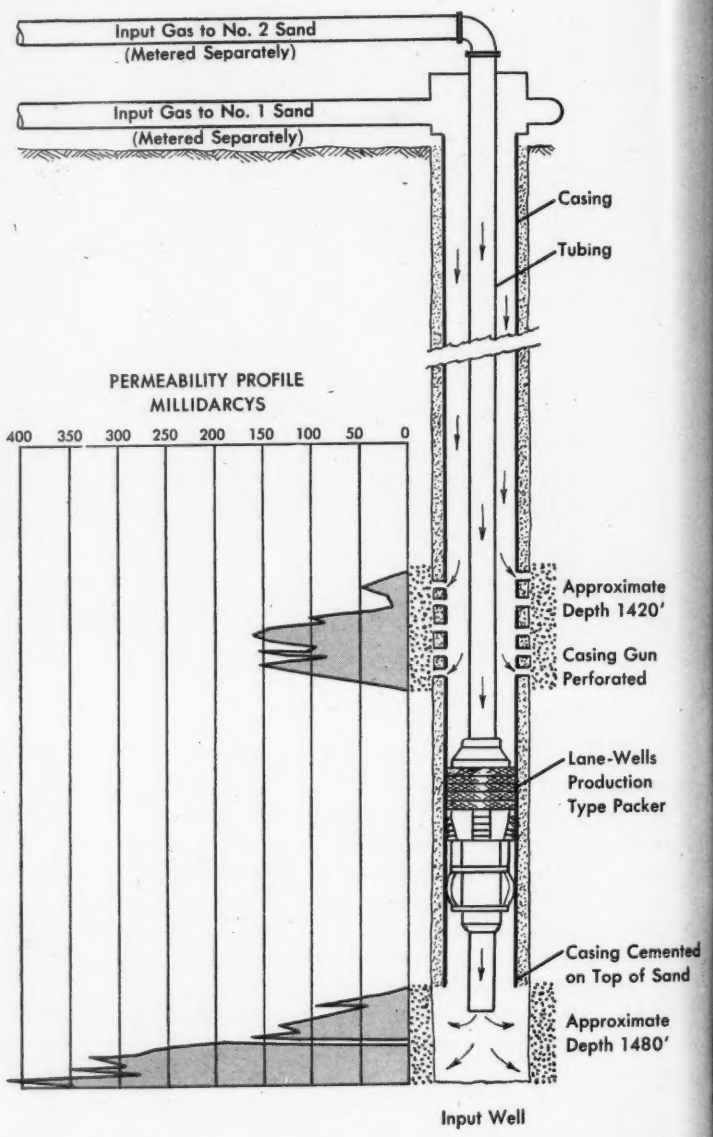


Figure 5

Chas. S. Jones, President of the Richfield Oil Corporation.

RICHFIELD'S ROLE in 100-OCTANE PRODUCTION

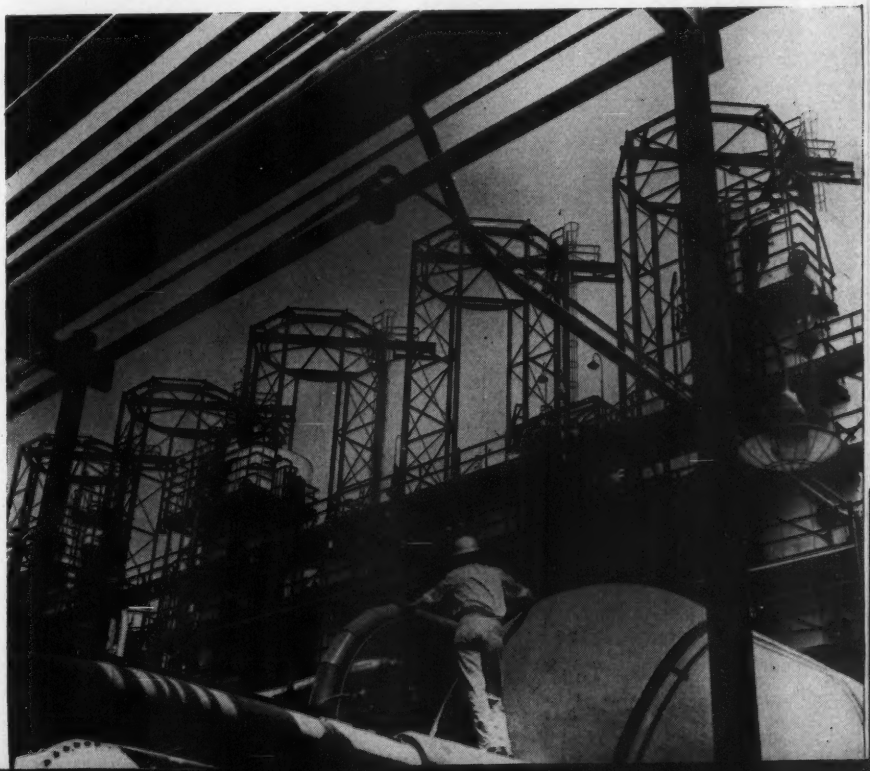
The part that 100 plus octane gasoline has played in fueling our war machine, and the job that the oil industry has done in making this super fuel available in almost unbelievable quantities are among the foremost technical achievements of the war effort. This super gasoline has enabled the Allied Nations to build and operate planes that will fly higher, faster, and further than those of our enemies; that will take off more rapidly and carry greater bomb loads.

Richfield takes pride in its part in the big job of making more and better gasoline faster, and in its great new refinery just completed at Watson. One of the penalties of leadership in this complex and competitive field has been the constant and costly improvement in refining processes which transform crude oil into better motor fuels.

The history of Richfield spans three decades and three refineries. Each took full advantage of the refining technology of the day and was, at the time of construction, the last word in efficiency. Yet each has been made obsolete by new developments and technical advances in the science and technology of refining.

Richfield's policy of continuous improvement has contributed to, and hastened, the development of many

Thermal cracking furnaces of the combination units. These units are part of Richfield's 1938 plant construction that have been adapted to aviation gasoline production.



new refining processes that make today's quantity production of 100 plus octane gasoline possible. This outstanding fuel has been in production at Richfield's Watson refinery since 1940. At the time of Pearl Harbor, this was one of the few refineries in the world equipped to produce the fighting fuel our expanding air forces needed so desperately. Starting in at a mere trickle four years ago, Richfield's production of 100+ octane gasoline at Watson has grown into a flood. In those few years over 300,000,000 gallons of this vital war fluid have been produced at this one plant, enough to fuel 166 raids of 1,000 four engine bombers over Germany. Starting with only a few hundred barrels a day in 1940, production today is more than 800,000 gallons a day, enough to fuel a round trip of 1,000 of these big bombers from China over Japan every fourth day. Some of this increase was due to improvement in the technology of aviation fuels, new ingredients and new additives. Much was due to the installation of new equipment including this latest new catalytic cracking installation. But much was due to the ingenuity and "know how" of Richfield men—to the operators, the engineers, the chemists, and the executives who have concentrated on one thing—making ever more and better fighting fuels.

Albert M. Kelley, Vice President in charge of manufacturing.

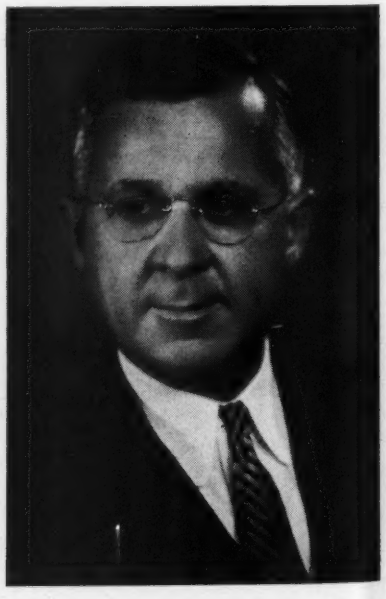
In the business world, as in battle, experienced, dynamic leadership is essential to a successful campaign. Who are the leaders who direct Richfield's progress? Charles S. Jones came to Richfield after a distinguished experience as director, vice president and treasurer, and finally president of Rio Grande. Since the Richfield - Rio Grande merger in 1937, Mr. Jones has served as president of the Richfield Oil Corporation. In addition to many other civic and industrial duties, Richfield's president has served as chairman of the Supply and Transportation Committee for District V since its original formation. His appointment was made by the Petroleum Administrator for War.

In charge of Richfield's aggressive sales force is W. T. Dinkins. Joining Richfield in 1937 as vice president in charge of marketing, Mr. Dinkins brought with him a rich experience in sales work resulting from many important posts which he had held in the Sinclair Refining Company in the east and mid-continent areas. Prior to his present position at Richfield, Mr. Dinkins has served as assistant to the vice president at Sinclair's executive offices in New York and as sales manager of the southwest district at Fort Worth, Texas.

Richfield has always sought to entrench itself in a strong position in the matter of petroleum reserves.

W. T. Dinkins, Vice President in charge of sales.

Frank A. Morgan, Vice President in Charge of Exploration.



R. D. Montgomery, Manager of Exploitation.

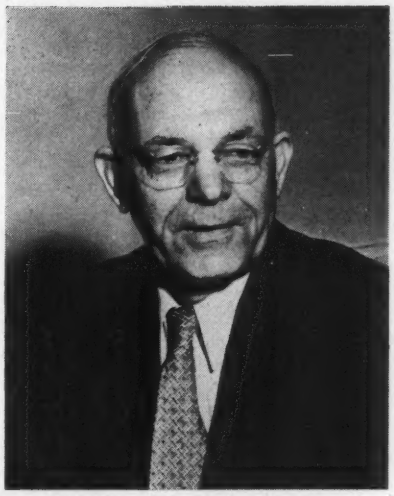
Heading the exploration work that has given the company its present substantial back log of crude oil is Frank A. Morgan, vice president in charge of exploration. Mr. Morgan, a native son, is a graduate of the University of California. He was made chief geologist of Rio Grande in 1929, and was elected vice president of Richfield in 1938, shortly after the Richfield-Rio Grande merger.

Albert M. Kelley, vice president in charge of manufacturing, is the real "old timer" of Richfield, having been with the company continuously since the founding of the original Richfield Oil Company in 1914. Under his guidance the manufacturing facilities of the company have expanded from the first topping plant at Bakersfield to the ultra-modern multi-million dollar installation now operating at Watson. In addition to refining, Mr. Kelley has charge of the operation of Richfield's pipe line and marine departments.

C. R. McKay came to Richfield as manager of refineries with a background of long experience in California and the mid-continent. Immediately prior to his present position with Richfield, Mr. McKay had been in charge of the Sinclair refinery at Sand Springs, Oklahoma. He and his staff at Watson have had direct charge of the company's refinery expansion program, culminating in the completion of the great new installation described in the following articles.

High army and navy officials, dignitaries from the eleven western states and over 3000 employees and guests gathered at Watson, California, for the Richfield 100 Octane refinery dedication on October 5.

The impressive ceremonies marked the culmination of almost four years of continual expansion and development by the Richfield Oil Corporation in the 100 octane gasoline production program.

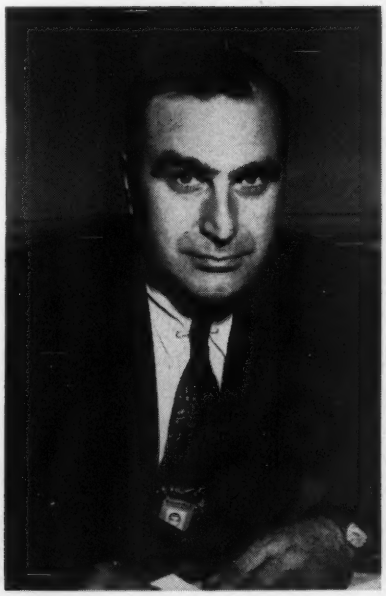


R. A. Panero, Superintendent of Refineries.

W. R. Davis, Assistant Superintendent of Refineries.

C. R. McKay, Manager of Refineries.

E. C. Herthel, Manager of Research and Development.



Frank Fontana
Resident Engineer

David Day

AVIATION GASOLINE

from Richfield's New Refinery

By C. H. DAY, JR.
Chief Processing Engineer

C. H. Day, Jr.

The tremendous aviation gasoline construction program recently completed at Richfield's Watson Refinery marks the culmination of four years of almost continual expansion of the company's facilities for producing the super aviation fuel which is so vital to the successful prosecution of the war.

The first units which contributed directly to the production of 100 octane gasoline were an alkylation unit and a deisopentanizer which were placed in operation in 1940. An ample supply of butylene was available from two modern combination units which were built and placed in operation in 1938, and sufficient isobutane was available in crude oil and natural gasoline. In the alkylation unit, butylenes and isobutane are chemically combined by intimately contacting with strong sulphuric acid at low temperatures and in the presence of a large excess of isobutane. The resulting alkylate consists largely of branched chain octanes or iso-octanes. The octane rating of alkylate is considerably higher than 100 when the permissible quantity of tetra ethyl lead is added so that it is possible to blend a considerable amount of material which rates below 100 octane and still meet the 100 octane number specification of the finished gasoline. For this reason alkylate and some other compounds which rate considerably above 100 octane are known as blending agents. Isopentane is a compound which is present in natural gasoline and in crude oil and can be separated therefrom by precise fractionation. The quantity that can be used is limited by vapor pressure specifications on the finished gasoline, but up to that quantity it is an extremely valuable blending agent, being superior to alkylate in lean mixture rating (cruising performance) and only slightly inferior in rich mixture rating (combat performance). It can be seen, therefore, that the construction of an alkylation unit and a deisopentanizer to operate in conjunction with an existing debutanizer gave Richfield the primary constituents necessary for the production of 100 octane aviation gasoline in commercial quantities.

Richfield early recognized the importance of dependanizing the straight run base stock with subsequent recovery of isopentane and such an operation was started early in 1941 using available equipment.

As a result of an intensive laboratory study of the octane numbers of various fractions of the straight run and natural gasoline available, the commercial separation of a very sharply cut dependanized 195° E.P. base stock was inaugurated early in 1942. This was accomplished with available equipment by shutting down the polymerization unit in order to use its depropanizer as a base stock dependanizer and by using the deisopentanizer alternately for isopentane production and 195° E.P. base stock separation. The effect of the new operation was to improve the base stock quality by about 3 octane numbers with a resultant very large increase in the production of 100 octane aviation gasoline.

After Pearl Harbor, the estimated requirements of 100 octane aviation gasoline increased tremendously. Richfield accordingly started an expansion program which included doubling the alkylation unit capacity by the installation of new fractionating columns, new reactors, additional refrigeration and other miscellaneous equipment. Since sufficient isobutane was not available to supply the expanded alkylation unit, a butane isomerization unit of the Shell Vapor Phase type was included in the expansion program. New fractionating towers for base stock preparation were also added since the equipment in use did not have capacity for the increased volume of base stock required. The expansion was completed in February, 1943.

Another important step taken dur-

Color photographs on cover pages of this section by Will Connell. Other photos by Will Connell, Hal Moulin, Eyre Powell.

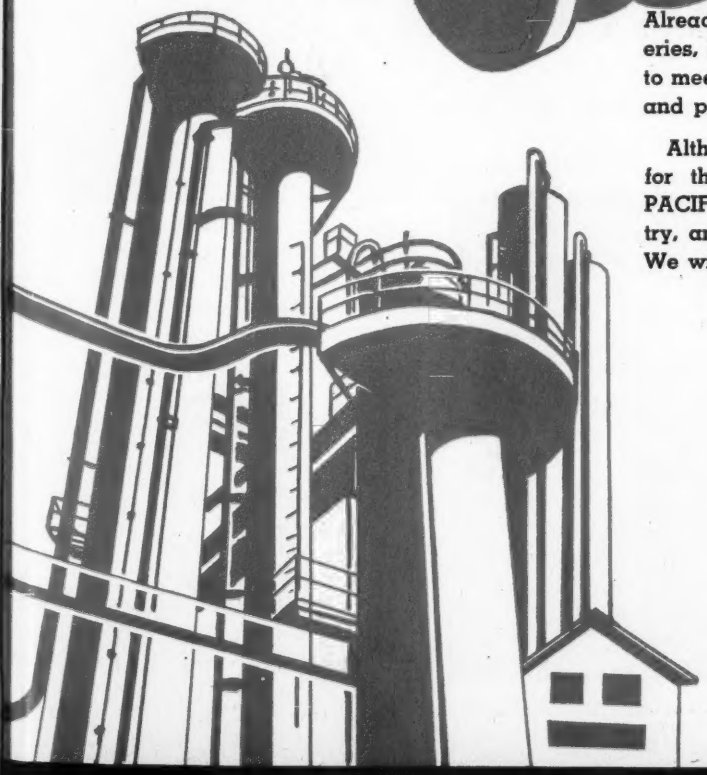
Sincere Congratulations to

RICHFIELD

on your 1000%* increased production of 100 Octane Aviation Gasoline!

*over 1940 production at Watson Refinery

THAT WILL HELP A LOT TO "KEEP 'EM FLYING"



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ing 1942 was the conversion of the polymerization unit to the manufacture of cumene. Since the original depropanizer was in other service, it was necessary to add a depropanizer as well as a debenzenizer and a cumene re-run tower. These towers as well as all other equipment were obtained from salvage in the interest of speed and the conservation of critical materials. The availability of cumene for 100 octane blending resulted in a nationwide increase in production of over 20% and a tremendous improvement in the rich mixture or combat performance of 100 octane aviation gasoline.

Before the first expansion was completed, plans for a second expansion were under way. These plans culminated in the Richfield plant as it is today and which includes in addition to the equipment already enumerated, two T.C.C. catalytic cracking units, a new alkylation unit of approximately the same capacity as the original expanded unit, additional superfractionation units, and a new boiler house.

The two T.C.C. units furnish all of the olefins and isobutane necessary for the new alkylation unit in addition to producing aviation base stock having a lean mixture rating almost equivalent to, and a rich rating better than, the present specifications for 100 octane. As a result of the extremely high rating of the base stock, practically all of the alkylate produced from raw materials originating in the T. C. C. units is available for blending additional straight run gasoline into 100 octane aviation gasoline. The secret of the results obtained with the T. C. C. units lies in the retreating or re-cracking of the distillate produced from gas oil with natural catalyst in the first unit with synthetic catalyst in the second unit.

All of the equipment placed in operation during 1944 was built by the Lummus Co. from designs formulated by Richfield and Lummus engineers working in the closest collaboration.

Straight-Run SUPERFRACTIONATION

By E. H. REYNOLDS and J. H. ROE

An extensive superfractionation program is carried out in the Watson Refinery of the Richfield Oil Corporation to separate light hydrocarbons into relatively pure hydrocarbons and to separate heavier hydrocarbons into fractions of high and low octane ratings. This program is carried out by the use of twelve interconnected fractionating columns ranging in diameter from 2½ to 12½ ft. and in number of bubble trays from 30 to 70.

The importance of the superfractionation units on Richfield's production of 100 octane aviation gasoline cannot be over emphasized. The straight run gasoline charged to the system is about 7 lb. R.V.P. and has a 1-C rating of 91 with 4.6 cc of lead. If this material were used directly as a base stock for 100 octane aviation gasoline the volume of 100 octane produced would be reduced to 75% of the present quantity, or to state it differently, the superfractionation equipment increases production of 100 octane by 33 percent.

E. H. Reynolds, Shift Foreman Light Oil Processing.

Process Flow

All of the available natural gasoline and all 320° E.P. straight run gasoline available in the crude run is charged to two depentanizers in parallel. This separation is an important one since any n-pentane left in the bottom will remain in the final aviation base and any iso-

J. H. Roe, Junior Process Engineer.

Close-up view of recently completed superfractionation area at Watson.

hexanes taken overhead represent a loss of extremely valuable components for 100 octane.

The overhead from the depentanizers consisting of pentanes and lighter passes to a debutanizer where butanes are taken overhead and pentanes are removed as a bottoms product.

The debutanizer bottoms are fed to a column for separation into isopentane and n-pentane. The former is an extremely valuable blending agent for 100 octane because of its exceptional anti-knock qualities while the latter, because of its low anti-knock rating, is suitable only for blending into motor gasoline. Because of the wide spread in value between these two pentanes, the equipment is designed for the recovery of over 95% of the available isopentane at a purity of above 95%.

The overhead from the debutanizer together with the effluent from the butane isomerization unit becomes the feed stock for a column where it is separated into a high purity isobutane overhead and n-butane bottoms. The isobutane is routed to the alkylation unit where it is combined with butylenes and amylenes to form alkylate.

Part of the deisobutanizer bottoms is used for motor gasoline blending and part for feed to the isomerization unit. The part that is used for isomerization unit feed is first processed in a column to eliminate pentanes formed in isomerization. In order to insure a substantially pentane free feed to the isomerization unit a considerable amount of butane is intentionally left in the bottoms.

The bottoms from the preceding column is debutanized along with refinery absorption gasoline, with the butane and lighter overhead being pumped to motor gasoline and the pentane bottoms to the previously described deisopentanizer.

The bottoms from the two depentanizers first described constitute the feed to a column where a hexane-isoheptane fraction is taken overhead. This material has a 1-C rating of about 95.5 and a 3-C rating of S + 0.2 after blending to 7 lbs. R.V.P. with isopentane and the addition of 4.6 ml. of T.E.L. per gallon. There is a very sharp break in octane number at the overhead cut point of 195° F. and as a consequence very good fractionation

and precise control are necessary for this separation.

The bottoms from the preceding column are processed in a column for the separation of an overhead cut having a true boiling point range of 195°-235° F. The bottoms are hydroformed at another refinery to high quality aviation base stock. The same high degree of fractionation and precise control mentioned as necessary for the 195° cut is also required for this separation since the octane break is even more pronounced.

The 195°-235° F. overhead fraction from the preceding column is processed in a column for separation into a 195°-217° F. cut as overhead and a 217°-235° cut as bottoms. The octane characteristics of the two fractions after blending to 7 lb. R.V.P. with isopentane and the addition of 4.6 ml. of T.E.L. per gallon are about as follows:

Boiling Range	1-C	3-C
217°-235°	95.0	S + 0.2
195°-217°	91.0	97% S in M

The 217°-235° cut and the 195° E.P. cut are used exclusively in 100 octane aviation. The 195°-217° cut is used to balance 100 octane requirements with any surplus being blended with n-butane, n-pentane and 235°+ material for 87 octane aviation.

A butane-pentane blend from the alkylate dependanizer at No. 1 alkylation unit is debutanized. The butane overhead forms part of the isomerization unit feed stock and the bottoms are routed to the deisopentanizer previously discussed for recovery of isopentane.

Auxiliary Equipment

Heat is supplied to the reboilers of the units from three different sources. Those with the lowest temperature requirements are supplied with 40 lb. exhaust steam from the turbines driving various pumps in the system. The units with intermediate temperature requirement are supplied with 150 lb. steam from the boiler house. For the units with the highest reboiler temperature requirements heat is supplied by a 600° F. heat medium system. The heat medium system consists of straight run gas oil circulating through the reboilers and a large gas or oil fired heater located at a distance from the fractionation units. This heater was designed for 90,000,000 BTU per hour absorption. Cooling requirements are taken care of by a 13 cell induced draft cooling tower, which can be operated as one unit or two independent units. The cooling water in the system is chemically treated to prevent lime deposition and to control algae.

ALKYLATION

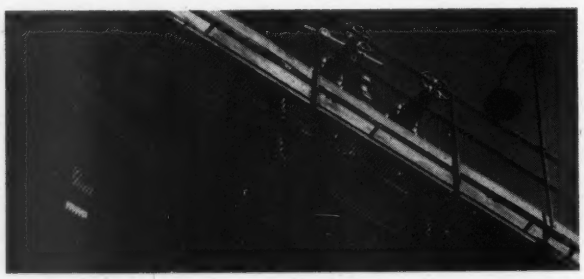
By R. P. CORLEW and W. F. DEETER

Alkylation facilities at Richfield Oil Corporation's Watson refinery consist of two sulfuric acid alkylation units. The No. 1 unit, originally constructed in 1940 with a nominal capacity of 700 barrels per day, was expanded in 1942 and is currently producing in excess of 2100 barrels per day of dependanized aviation alkylate from butylenes and amylenes produced by thermal cracking and reforming. The No. 2 unit, recently completed, processes butylenes produced in the Thermofor Catalytic Cracking units and produces a substantial quantity of high quality aviation alkylate. The two units are interconnected in such a manner that isobutane and olefin stocks can flow from either unit to the other or to and from plant storage.

Unit No. 1

The No. 1 unit incorporates separate butylene and amylene alkylation, the olefin feed stocks being supplied as a butane and lighter fraction and a pentane amylene fraction from the thermal cracked distillate fractionation area. Additional isobutane is supplied from the straight run fractionation and isomerization area.

The unit employs four Stratco refrigerated contactors, which are paired. One pair operates in parallel on amylene feed and the remaining pair processes butylenes. Refrigeration is supplied by three ammonia compressors having a com-



PROTECTING ELUSIVE VOLATILES

at a California aviation gasoline plant

This close-up view of a HORTONSPHERE was taken at the Richfield Oil Corporation's Watson Refinery. At this location, as at many of the nation's 100-octane gasoline plants, Hortonspheres provide the kind of storage that stops evaporation during the handling and storing of elusive volatiles.

The volatile components of 100-octane gasoline such as butane, isobutane and alkylate, would disappear into thin air if they were not "shackled" during their handling and storage. A positive barrier against evaporation loss is provided by Hortonspheres, pressure storage tanks that hold their contents under pressure and thereby prevent loss through evaporation. Product deterioration resulting from excessive evaporation is also minimized through use of the Hortonspheres.

The Hortonsphere operates on the simple principle that no vapor loss will occur as long as the pressure inside of the tank does not exceed the setting of the relief vents. The fact that pressure builds up is indicative that no vapor loss is occurring.

When you require pressure storage tanks of from 1,000 to 20,000 bbls. capacity for pressures from 20 to 100 lbs. per sq. in., investigate the Hortonsphere. Let us know your requirements.

PHOTO BY WILL CONNELL

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bined capacity of approximately 830 tons.

As neither the B-B fraction nor the isobutane feed has been depropanized before entering the unit, two depropanizers are provided. The re-

W. F. Deeter

cycle depropanizer is fed by a portion of the deisobutanizer overhead plus the fresh isobutane feed. Sufficient deisobutanizer overhead is fed to this column to maintain the propane content of the contactor feed at a low level. The remainder of the deisobutanizer overhead flows directly to contactor feed. The B-B depropanizer processes the overhead from the cracked distillate debutanizer. The bottoms flow to the butylene contactors while the overhead release gas supplies propylene feed to the cumene unit.

The alkylation section is operated with series flow on the isobutane and parallel flow on the two olefin feeds. The entire isobutane feed, along with the pentane-amylene feed passes through the first pair of contactors, and into an acid settler. The acid free hydrocarbon is joined by the chilled butane - butylene stream and fed to the second pair of contactors. After removal of the acid in a second settler the acid free hydrocarbon passes through a final settler, is neutralized in a caustic wash, and then flows to the fractionation section.

This arrangement of hydrocarbon flow permits taking advantage of a high isobutane to olefin ratio in the amylene contactors without resulting in a lower ratio in the butylene system than would be obtained with a split isobutane feed.

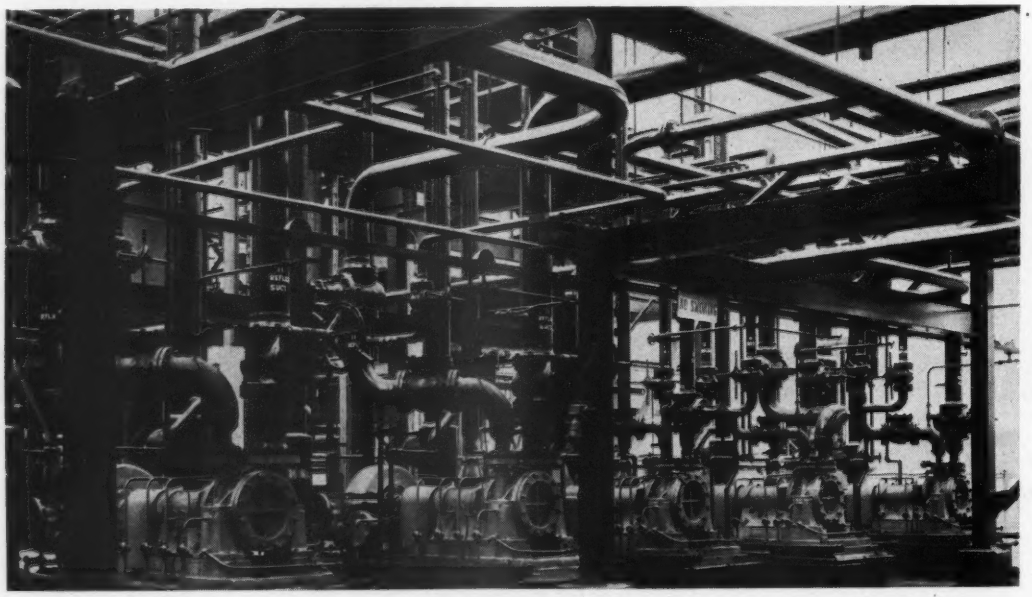
The effluent from the alkylation section is deisobutanized in two parallel deisobutanizers. The second column was added during the 1942 expansion program. As previously mentioned the overheads from these columns split between recycle depropanizer feed and contactor feed. The deisobutanized bottoms flow to a dependanizer where an overhead product of normal pentane and lighter hydrocarbons is produced. This stock is transferred to the straight run fractionation area where the normal butane is recovered for isomerization unit feed and the isopentane segregated for aviation fuel blending. The dependanized total alkylate is rerun to produce an aviation alkylate overhead and heavy alkylate bottoms.

Unit No. 2

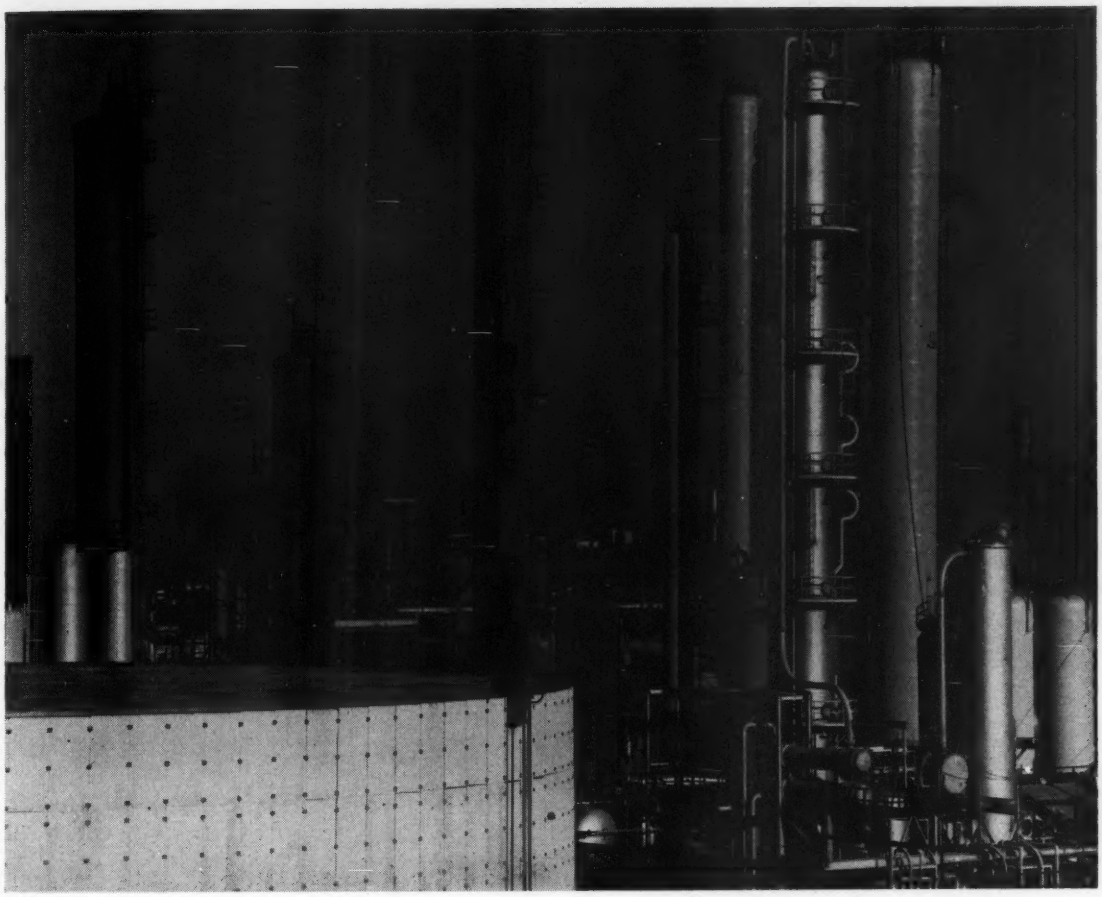
The No. 2 unit processes catalytic butylenes primarily; however, thermal butylenes or amylenes may be transferred from the No. 1 unit if excess capacity is available. The feed to the unit is supplied as a depropanized butane - butylene cut from the T.C.C. distillate fractionation area, and, as the catalytic B-B stream contains more isobutane than will combine with the butylenes produced, no additional source of isobutane is necessary.

The unit employs two Stratco refrigerated contactors, the refrigeration being supplied by three ammonia compressors having a combined capacity of approximately 1200 tons.

The B-B feed, before entering the alkylation system, is treated in a two stage caustic wash unit. The first stage or prewash is for the removal of traces of hydrogen sulfide and organic acids which may be present in the feed. The second



View showing Union steam pump installation.



View of super fractionation area.

stage, employing a packed column and caustic reclaiming, is for mercaptan removal.

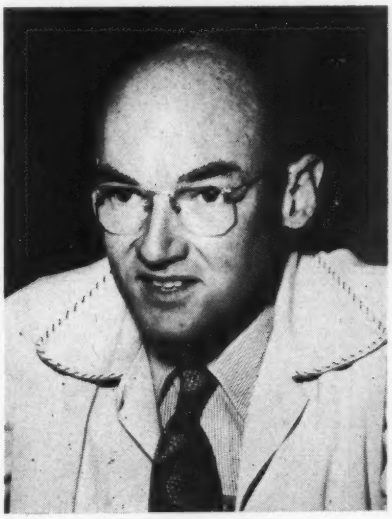
The contactor feed, consisting of recycle isobutane and the catalytic B-B fraction, passes through the two contactors in parallel, after having been chilled and dehydrated. Acid is separated from the contactor effluent in a settler and recirculated to the contactors. The hydrocarbon from the acid settler passes through a second settler, is neutralized in a caustic wash system, and then flows to the fractionation section.

Batch acid feed is employed on this unit. That is, a quantity of fresh 98-99 per cent sulfuric acid is charged to a settler and circulated through the contactors until the desired discard strength is reached. A freshly charged settler is then put into circulating service and the spent acid is settled and dumped. The settler is then recharged and returned to circulating service when needed. The two settlers are so manifolded that either vessel can be placed in the circulating position. The settler being dumped and recharged acts as a final settler.

The alkylation system product is first fractionated in a deisobutanizer. Part of the overhead returns directly to contactor feed while the remainder is depropanized in the recycle depropanizer. The bottoms from this column return to contactor feed.

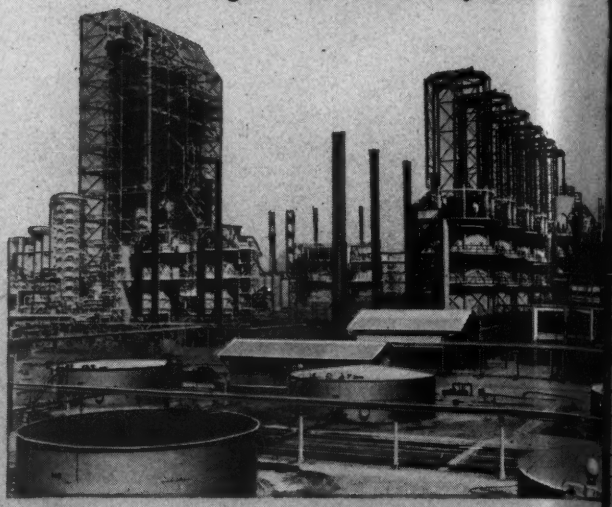
The deisobutanizer bottoms flow to a debutanizer where normal butane is produced and may be routed to the straight run fractionation area for isomerization unit feed or may be segregated for motor gasoline blending.

The debutanized total alkylate is re-run for the production of an aviation alkylate overhead and heavy alkylate bottoms. As the re-run column on the No. 1 unit was found to be inadequate for the current production rate, this equipment on the No. 2 unit was designed with sufficient capacity to re-run part of the No. 1 unit's production.



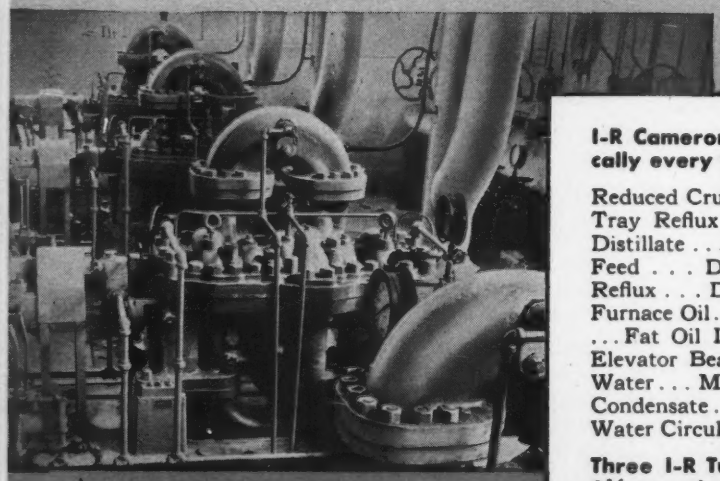
R. P. Corlew

Seven 600 BHP, two-stage, Type KVG Gas Engine Driven Gas Compressors.



COMPRESSORS, TURBO-BLOWERS AND CENTRIFUGAL PUMPS

SERVE RICHFIELD'S NEW AVIATION GASOLINE



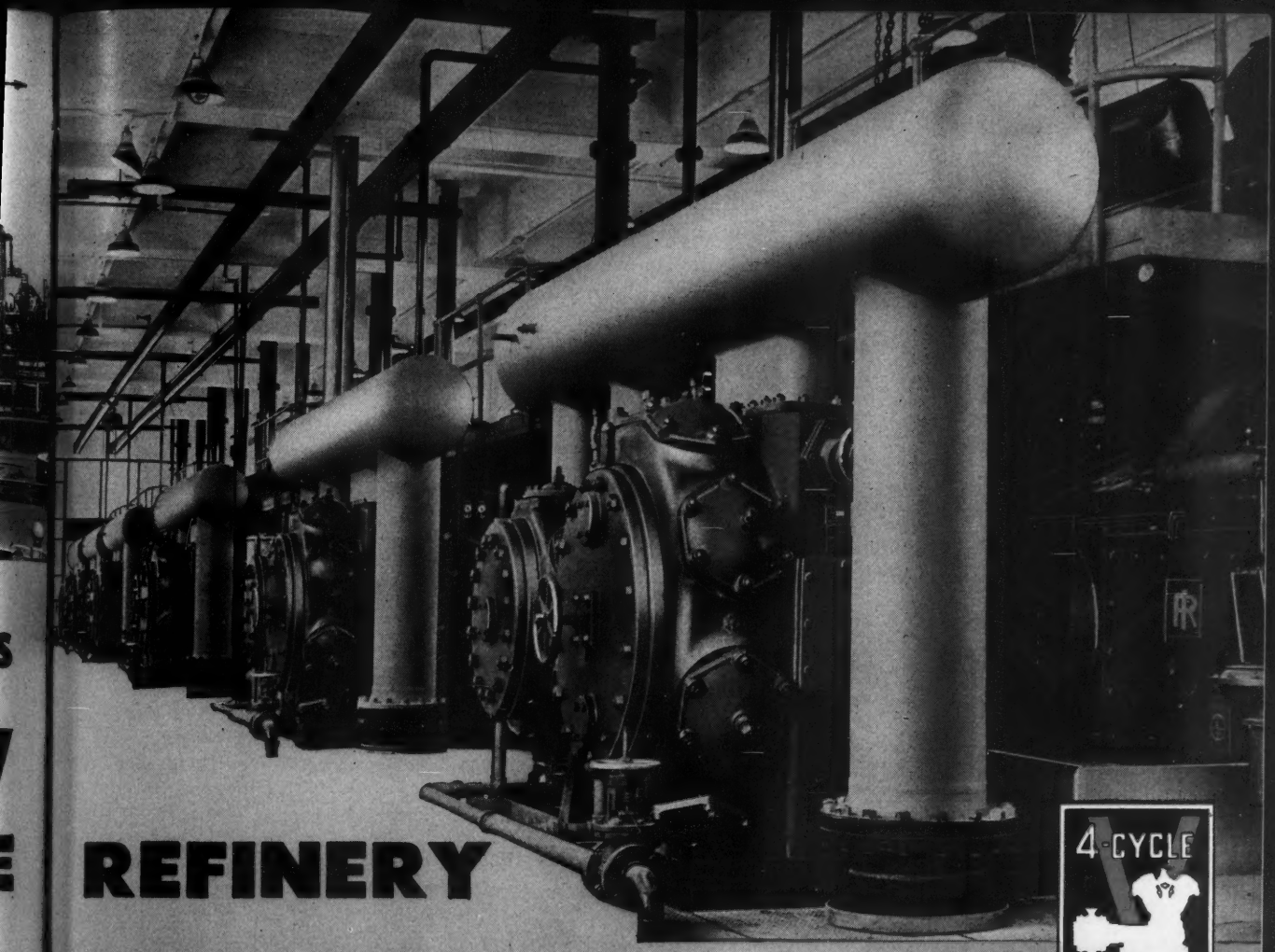
Richfield's new steam plant produces enough power for a city the size of Spokane. Here are 4 six-stage, 455 HP, Ingersoll-Rand boiler-feed pumps.

I-R Cameron Centrifugal Pumps are on practically every fluid stream in this new plant . . .

Reduced Crude Charge . . . Gas Oil Charge . . . Top Tray Reflux . . . Cracked Distillate . . . Treated Distillate . . . Recycle Naphtha . . . Depropanizer Feed . . . Debutanizer Feed . . . Depropanizer Reflux . . . Debutanizer Reflux . . . Lean Oil . . . Furnace Oil . . . Fuel Oil . . . Heavy Gasoline Charge . . . Fat Oil Intercondenser . . . Stripper Reflux . . . Elevator Bearing Water . . . Compressor Jacket Water . . . Main Water Supply . . . Back Wash . . . Condensate . . . Desuperheater . . . Booster . . . Kiln Water Circulating . . . Boiler Feed.

Three I-R Turbo-Blowers furnish 96000 cfm, 2½ pound air for the Catalytic Process.

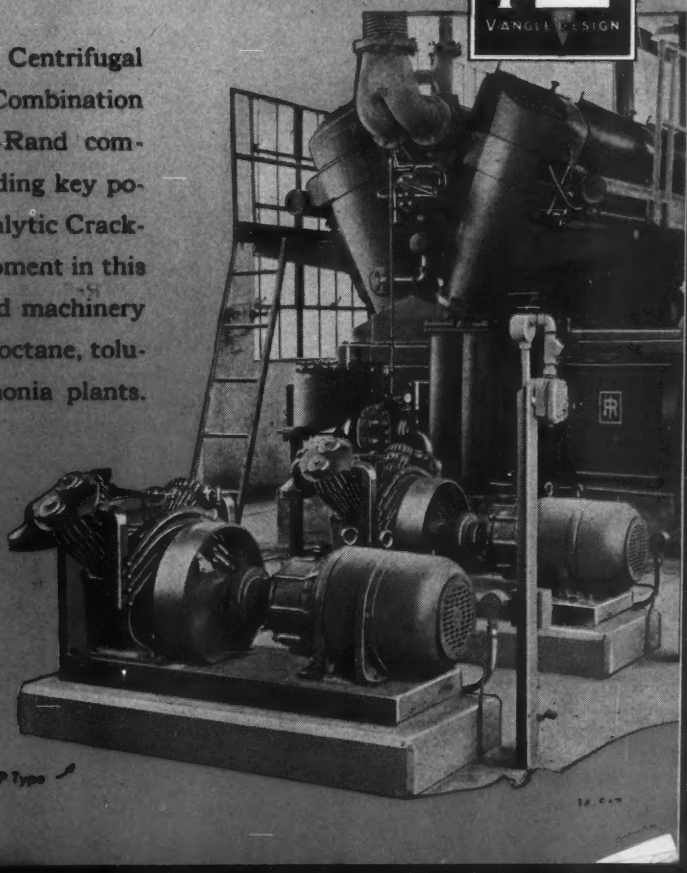
Two I-R Cameron six-stage, heavy gasoline charge pumps each operating against a total head of 750 feet.



REFINERY

4-CYCLE V-ANGLE DESIGN

In 1937 Ingersoll-Rand supplied all the Centrifugal Pumps and Compressors for Richfield's Combination Cracking Units. Again in 1944 Ingersoll-Rand compressors, turbo-blowers and pumps are holding key positions in the new Richfield Thermofor Catalytic Cracking Plant at Watson, California. The equipment in this installation is typical of the Ingersoll-Rand machinery serving in most of this country's vital high-octane, toluene, synthetic rubber and synthetic ammonia plants.



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I-R Starting Units serve the seven 600 HP Type KVG Compressors.

General plant view of Richfield's aviation gasoline refinery, super fractionation area center foreground and cracking furnaces in background.

THERMOFOR CATALYTIC CRACKING

By L. F. STRADER and F. G. HILL

The two huge Thermofor Catalytic Cracking Units installed at the Watson Refinery of the Richfield Oil Corporation as part of the gigantic expansion program to increase the production of 100 octane aviation gasoline make a major contribution to the increased output of this vital fuel.

By a two-pass operation using natural clay catalyst in the first unit and the synthetic catalyst beads in the second unit, an aviation base stock is produced which, without further treatment, nearly meets the high quality requirements of 100 octane aviation fuel. In addition butylenes and isobutane are produced in quantities sufficient to yield more than enough alkylate to blend the catalytic base stock to 100 octane aviation gasoline specifications. The excess alkylate permits the inclusion of additional straight run gasoline in the aviation blend so that the contribution of the catalytic units to 100 octane production exceeds the actual production of gasoline stocks therefrom.

The 240-foot high steel structure provides the support for the kilns, reactors, elevators and auxiliary equipment for both units. One of the units is arranged for cracking and one overhead for retreating (or reforming) the product from the cracking operation. Each unit consists of two reactors, two Jeffery elevators, and one Thermofor kiln. The catalyst burning and cooling auxiliaries are conventiently located within the structure. In addition, the equipment necessary for the safe and efficient control of catalyst circulation are mounted in the structure.

The distillation and heat exchange equipment is conventional in design, although there is some variation between the cracking and treating units. The cracking side is provided with a gas oil vaporizing tower for the preparation of the reactor charge stock. The reactor product is fractionated in a bubble tower equipped with bubble and shower decks. A stripper is provided to remove the gasoline fraction from the bubble tower gas oil side stream.

The treating side has a duplicate of the bubble tower and side stream stripper, but does not have a gas oil vaporizing tower.

Two DeFlorez heaters are provided for vaporization of the reactor charge and the vaporized gas oil is then super-heated in a Lummus box type heater. The treating unit is provided with two DeFlorez heaters identical to the cracking vaporizing heaters except for tube arrangement.

The gas recovery and stabilization equipment is also conventional. The units operate at low pressure and the uncondensed gases are picked up by gas engine driven compressors (three for cracking and three for treating). A depropanizer and a debutanizer are provided for the cracking system and a debutanizer is provided for the treating side. An absorber and a fat oil still are provided for recovery of light hydrocarbons released from the comingling operation. A Girbotol H_2S extraction unit is provided for puri-

fication of the process release gases used for compressor engine fuel.

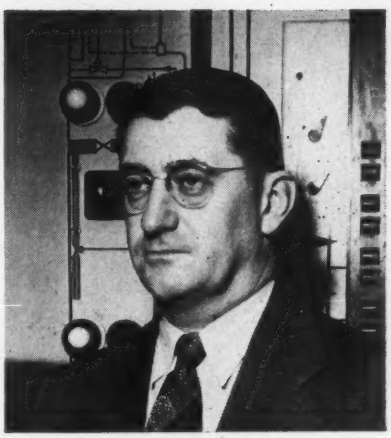
A three level concrete structure adjacent to the north side of the main steel structure houses the centralized control room and pumping equipment handling charge stocks and the light hydrocarbons. The accumulators are located on the second level and the shell and tube condensing equipment for both T.C.C. units and the stabilizing units are located on the third level.

Pumping equipment handling hot oils is located adjacent to the towers of each of the cracking and treating units. Electrical switch gear is also conveniently housed in concrete and brick buildings at the east and west extremes of the area covered by the units, providing a safe and centralized location for each unit's controls.

Catalyst Flow

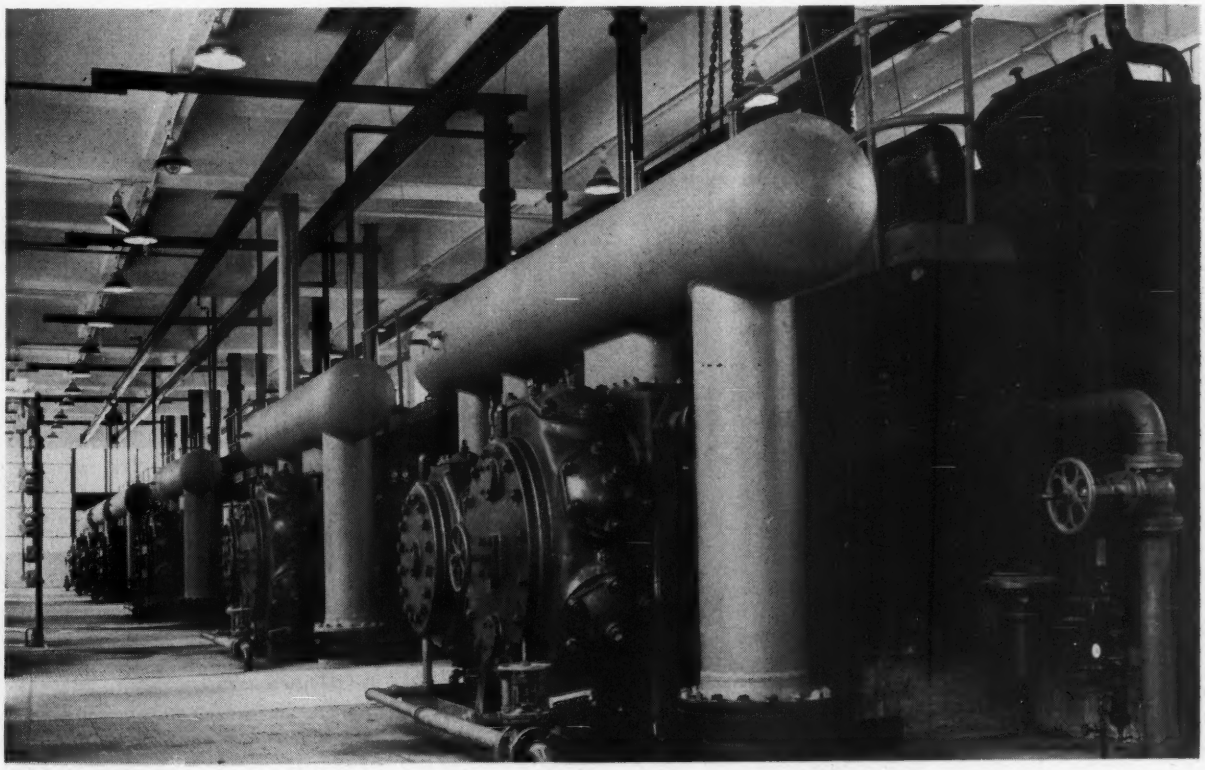
Each unit is equipped with separate but identical equipment to handle an inventory of some 600 tons of pelleted catalyst in a continuous cycle. The regenerated catalyst entering the reactor feed hopper flows downward through two solid bed reactors in parallel. Here it is contacted with the vaporized and super-heated reactor feed stock, and the catalytic cracking reaction takes place, converting the charging stock into a synthetic blend containing many components required for the production of aviation gasoline. Seals are provided to eliminate the loss of feed stock through the reactor catalyst inlet and outlet connections. The inventory of catalyst in the reactor can be varied which permits a change of reaction time factor without a change of feed rate if desired.

In the catalytic cracking step, a small amount of carbon is deposited on the catalyst which must be removed in a regenerating step to maintain the catalyst in a highly active state. This regeneration is accomplished in a thermofor kiln by ten successive burning and cooling steps as the catalyst passes downward through the kiln. The controlled feed of preheated air to a burning zone results in a burning

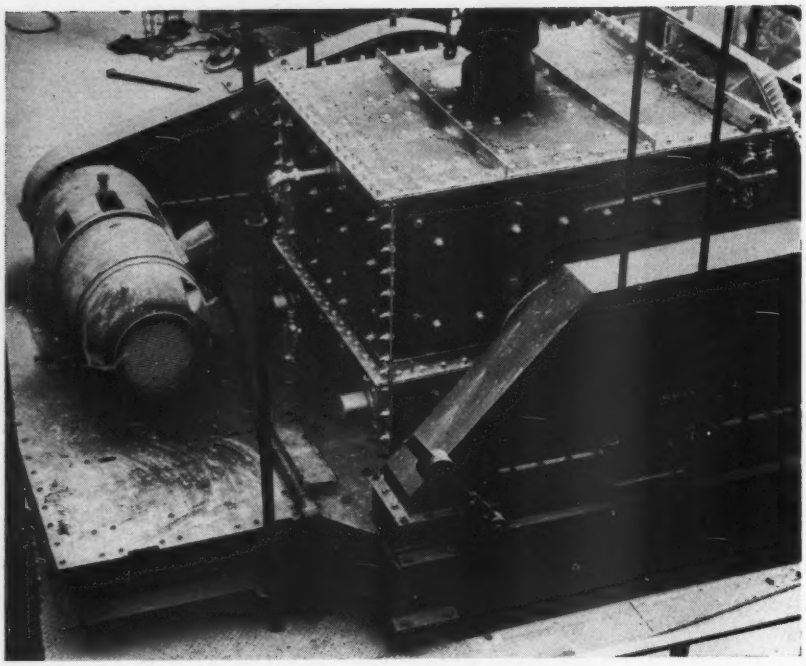


L. F. Strader, Foreman Light Oil Processing.

of the carbon deposit on the catalyst and a corresponding liberation of heat which is removed in cooling zones following each burning zone. By this stepwise burning procedure it is possible to maintain suitably high temperature to assure good regeneration and at the same time avoid a loss of catalyst activity due to excessive temperatures in regeneration. Heat removed from the kiln



Interior view showing battery of Ingersoll Rand Compressors. Each unit develops over 600 H.P.



Top side view of Jeffries clay elevator on the T.C.C. unit. Jeffries installation is used to move the beads from the catalyst chamber to the regeneration kiln and back again.

in the cooling zones generates 550 pound steam in sufficient quantity to form a substantial portion of the total steam requirements of the unit.

Jeffery continuous bucket chain type elevators provide the means of transferring regenerated catalyst from the bottom of the reactor to the kiln feed hopper and from the bottom of the kiln to the reactor feed hopper to complete the cycle of continuous flowing catalyst.

The construction of the kilns differs from those of earier design in that it is the "solid bed", rather than the "cartridge packed type". The simplified design was made possible by the improvement of catalyst durability and particle size over that originally thought possible for the pelleted type of catalyst. Extensive changes have also been made in refractory lining and cooling coil construction to obtain equipment which will require a minimum of maintenance.

Cracking Unit Operating Flow

Feed stocks are pumped direct from storage by equipment within the unit area. Approximately 15,500 barrels per day of sweet reduced crude from which all material boiling below 400° F has previously been removed, is charged. In addition 7,750 barrels per day of gas oil obtained in the combination units is charged, a portion going through the bubble tower side stream exchangers into the gas oil vaporing towers for reflux and temperature control. The balance joins the topped crude stream and the mixture is preheated by exchange with bubble tower bottom circulating reflux. The preheated stock is flow controlled through four parallel coils in the two DeFlorez heaters (two coils each) and enters the gas oil vaporizing tower through two column transfer lines. The heater outlet temperatures are controlled to vaporize 15,000 barrels per day or 67% of the total charge to the tower.

The vapors leaving the vaporizer are divided into two parallel flows maintained equal by butterfly valves in the vapor lines adjusted as required by indicating flow meters. The vapor passes through drying tubes in the plenum chamber of the Lummus heater thence into the radiant section for super-heating. The super-heated vapors enter the reactors (still in parallel) and flow counter current to the catalyst through the reactor into the bubble tower.

The operation of the bubble tower is conventional in all respects. The control is by circulating a top and bottom stream for removal of heat by heat exchange with the incoming charge. The overhead is controlled to about 450° F end point. A gas oil side stream is drawn off for thermal cracking. A small percentage of bottoms is produced as fuel oil.

The vapors leaving the bubble tower pass through shell and tube

Two of the many Powell valves that have been installed on this project.

condensers to a separating accumulator. This vessel is maintained at atmospheric pressure. The uncondensed gases are picked up by gas engine driven compressors and co-mingled with the liquid from the accumulator, the co-mingling taking place in a cooler at some 150-lb. gauge pressure. The gases from this operation are released to an absorption system integral to the unit.

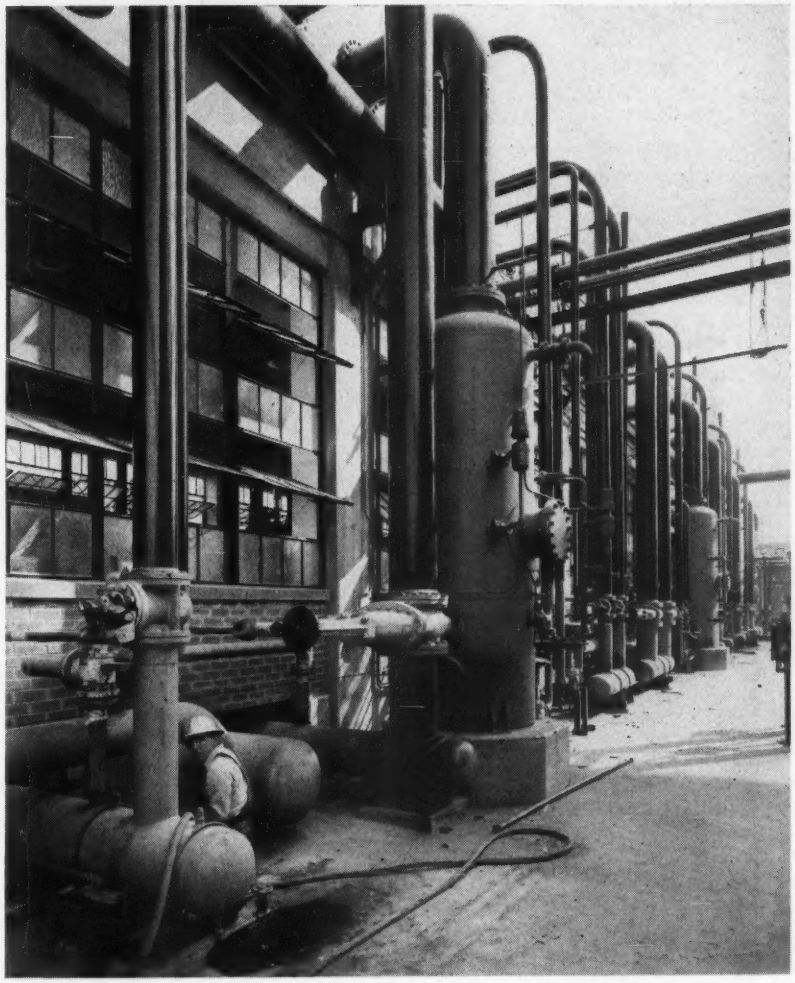
The depropanizer is charged with the liquid from the cracking co-mingler in mixture with the fat oil still overhead gasoline and the treating unit debutanizer overhead. The release gases are routed to cumene production to the limitation of the cumene plant and the excess goes to fuel.

The cracking debutanizer is charged with the bottoms from the depropanizer. The overhead from this operation becomes the charge to a sulphuric alkylation unit. The bottoms are sent to field storage incidental to recharging to the treating unit.

Treating Unit Operating Flow

The debutanized distillate from the cracking operation is charged from storage by pumps located within the unit area. This material is preheated by exchange with the hot stream of circulating bubble tower bottoms. The preheated stock is flow controlled through four parallel coils in the two De Florez heaters (two coils to each heater.) The vaporizing and superheating both occur in these heaters as the stock flows through them.

The vaporized and super-heated stock flows to the reactors in parallel, each heater going to a single reactor. These reactors are identical to those on the cracking side and have the same range of catalyst charge, namely approximately 20 to 100 ton each. The flow is also counter current to the flow of catalyst.



Nordstrom valves on the discharge line of the Compressor house of the T.C.C. unit. This Nordstrom installation is typical of numerous applications throughout the new Richfield refinery where a positive shut off is necessary.

The treated vapors enter the bubble tower for fractionation in the conventional manner. The overhead from this tower is controlled to aviation base stock boiling requirements A side stream is withdrawn through a stripper and charged back to the heaters with the incoming fresh charge stock. A small percentage of bottoms is drawn off to fuel oil.

The overhead product is condensed in shell and tube equipment at atmospheric pressure. The gases from this operation are compressed and co-mingled in a cooler with the liquid from the atmospheric accumulator-separator. The uncondensed gases go to the above-mentioned absorption system.

The co-mingled stock is charged to the treating debutanizer. This unit is operated for vapor pressure control of the aviation base stock and the overhead product is charged to the cracking unit depropanizer in mixture with the cracking unit co-mingled stock and the fat oil still overhead. The bottoms are polysulphide treated and are ready for 100 octane blending base.

CUMENE UNIT

By R. P. CORLEW and W. F. DEETER

The cumene unit at Richfield Oil Corporation's Watson Refinery is an example of what Petroleum Administrator for War Harold Ickes meant by the statement that the petroleum industry had pulled 100 octane aviation gasoline out of a hat.

The unit which was converted to the production of cumene was originally built and operated to polymerize propylene and buytlenes. The polymerized product, while a valuable constituent of motor gasoline, could not be used in aviation fuel because of its poor lead susceptibility. Accordingly, it was converted to the alkylation of propylene with benzol which produces the super blending agent, cumene. It was necessary to add three fractionating towers, a number of pumps, and miscellaneous equipment to the unit all of which were obtained from salvage in order to save time and to conserve critical materials.

Thermal depentanizer column. One of the first aviation gasoline units to be constructed at the Watson refinery.

The inclusion of cumene in 100 octane aviation gasoline has resulted in a volume increase of nearly 23%, not withstanding the fact that the actual volume of cumene in the finished blend seldom exceeds 8%. (In addition to the increased volume of 100 octane the use of cumene has made possible a tremendous increase in the rich mixture anti-knock quality. In other words, largely because of cumene, the present day gasoline while still called 100 octane (lean mixture rating) is infinitely superior to the earlier 100 octane under combat conditions.)

The unit employs four reactors, each containing two beds of catalyst. Two reactors operating in series are used in process service, while the remaining two are passing through the reactivation and hydration cycle.

Process Flow

The alkylation unit B-B depropanizer release gas, which supplies the propylene necessary for the reaction, is first treated for hydrogen sulfide removal in a tripotassium phosphate system. The treated gas is joined by a preheated benzene stream and passes through the process heater and through the two reactors. Reactor temperatures are controlled by regulation of the heater outlet temperature and also by the introduction of benzene quench between the reactor beds and between the two reactors. The reactor effluent is condensed and passes to a product surge drum from which some of the lighter hydrocarbons are released to the fuel system.

ANOTHER LUMMUS ENGINEERING ACHIEVEMENT

Richfield's new aviation gasoline project including . . . . Thermofor Catalytic Cracking . . . . Alkylation . . . . Super Fractionation . . . Boiler Plant . . . Feed Preparation Unit, etc.

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Fractionation of the product is accomplished in three columns, a depropanizer, a debenzenizer and a re-run column. The reactor product is first depropanized. The depropanizer bottoms flow to the debenzenizer which removes the unreacted benzene as overhead which is recycled to the reaction zone with the fresh benzene. The debenzenizer bottoms are fractionated in the re-run column to produce an aviation cumene as the overhead product.

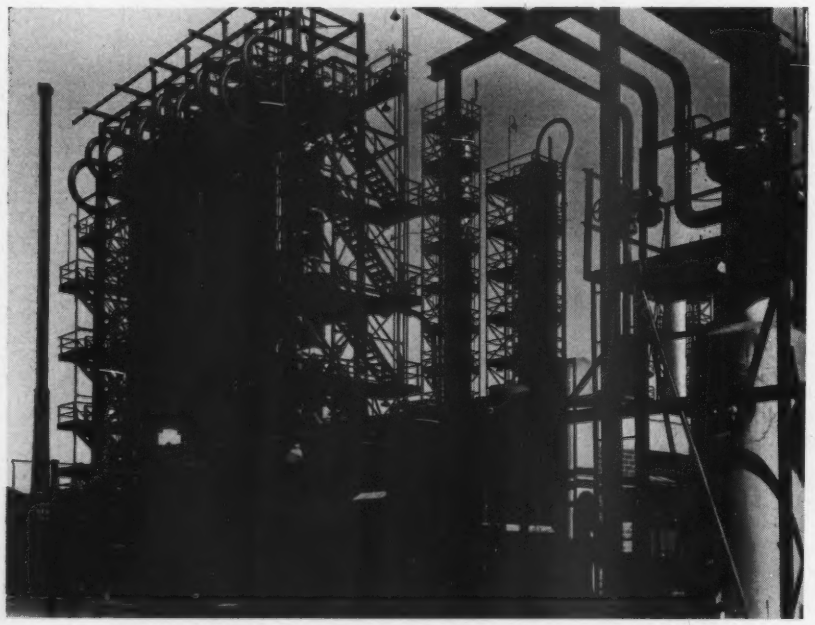
The yield of aviation cumene of the finest quality averages over 90% of the total cumene produced. The propylene conversion likewise averages above 90% while the yield of total cumene on benzol is almost the maximum which is theoretically possible.

Catalyst Cycle

Previous to being placed in process service, a reactor is hydrated with superheated steam and, in order to maintain the catalyst at the proper state of hydration while in process service, distilled water is introduced with the hydrocarbon feed.

The reactors are manifolded so that the new reactor is always placed in the final or clean-up position. When the lead reactor becomes spent it is dropped from process service, the final reactor is switched to the lead position and the new reactor is placed in the clean-up position. The spent reactor is purged and is then reactivated by burning. The burning rate is controlled by carefully regulating the percentage of oxygen in the heated flue gas passed through the catalyst.

Two Hortonspheres, installed at Richfield's Watson plant for the storage of light hydrocarbons. Spherical tanks shown here were constructed by the Chicago Bridge & Iron Company.



Reaction chambers of the Cumene production plant.

Isomerization

One of the basic ingredients of 100 octane aviation gasoline, without which commercial production would be impossible, is alkylate. This important material is produced by the chemical combination of olefins in the C_3 to C_5 range with isobutanes. Although isobutane is formed by both thermal and catalytic cracking, and in addition is present in natural gasoline and crude oil, the total quantity available at the refinery from all sources was insufficient to balance the olefins produced by cracking. There was available, however, an ample supply of n-butane, a hydrocarbon which is identical with isobutane in the number of atoms of carbon and hydrogen in the molecule but which differs in the atomic arrangement

within the molecule and which because of this difference is not susceptible to alkylation. Furthermore isobutane is thermodynamically more stable than n-butane throughout a wide range of temperatures. N-butane and isobutane are known as isomers and the process by which one is converted to the other is called isomerization. In order to convert n-butane to isobutane it is necessary to employ a catalyst to speed up the rate of reaction which, while thermodynamically feasible, under ordinary conditions, is extremely slow. The catalyst most generally employed in the butane isomerization processes so far developed is aluminum chloride. For installation at Watson, Richfield chose the vapor-phase process developed by the Shell Development Company.

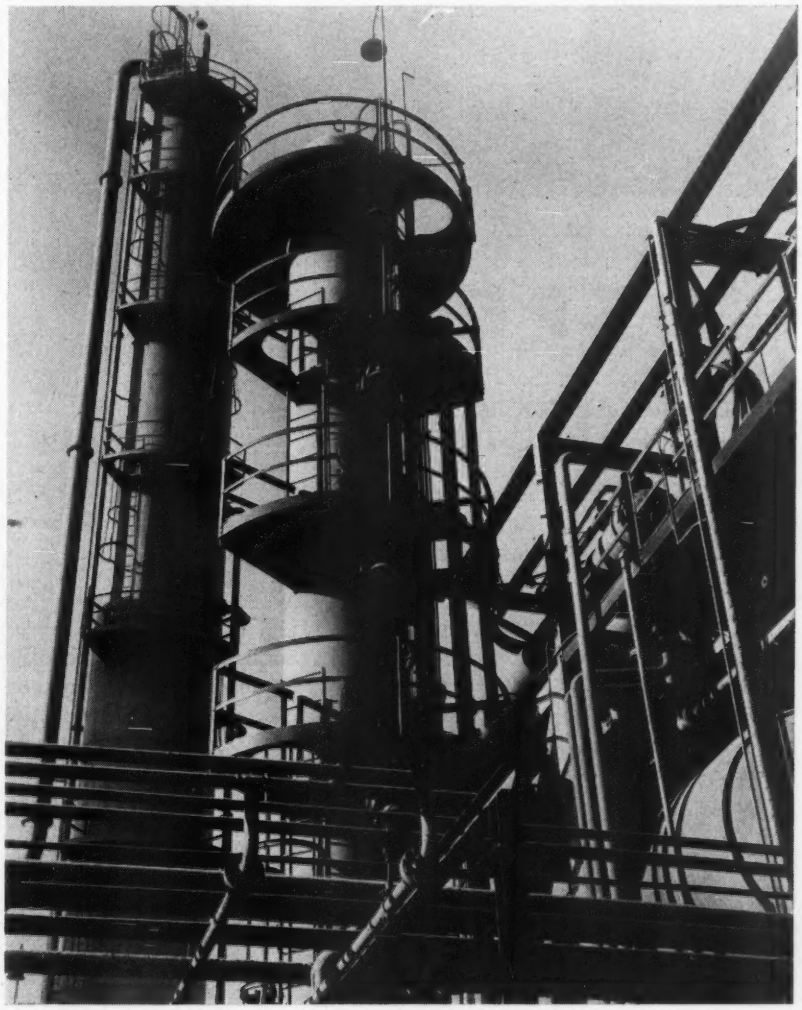
There are a number of factors which may adversely affect the isomerization reaction. These are (1) the tendency of aluminum chloride to act as a cracking catalyst, particularly on hydrocarbons heavier than n-butane, (2) the extreme susceptibility of aluminum chloride to poisoning by olefins or sulfur compounds, and (3) the extreme corrosion which will result from traces of moisture in the system. In view of these factors it is obvious that extreme care must be exercised in the preparation and purification of the feed stock and in the control of operating variables.

The Richfield unit, although one of the first built, has operated with a minimum of trouble and has from the start consistently produced more isobutane than was called for in the design. A continuous run of over seven months duration has recently been completed at an average isobutane production of 185% of the design rating. At the conclusion of this run a thorough inspection of the unit disclosed no appreciable corrosion. The absence of corrosion is particularly noteworthy in that the plant was constructed entirely of carbon steel.

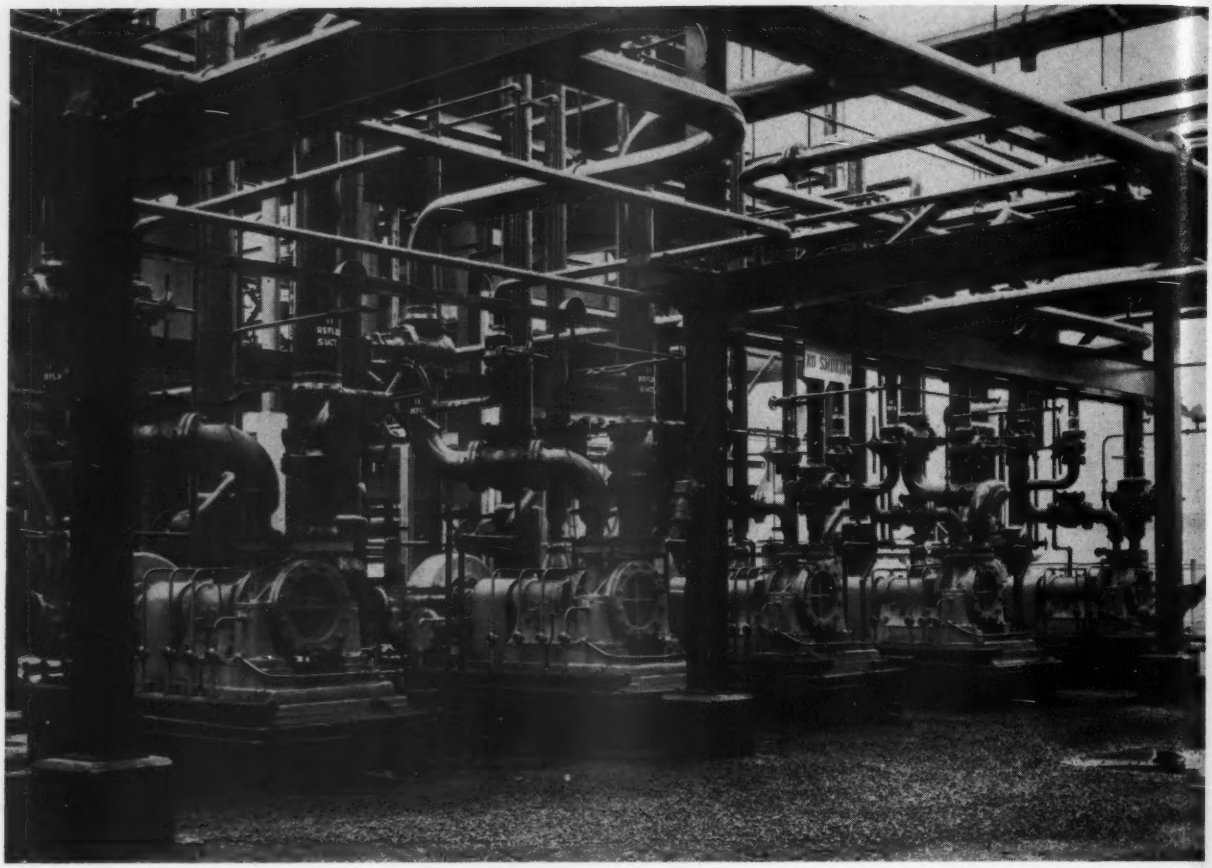
LABORATORIES

By C. K. HEWES

Built recently to keep pace with Richfield's rapidly expanding program for the manufacture of aviation gasoline, the laboratories, located at the Watson Refinery, are designed and equipped to obtain greatest flexibility and efficiency in plant control and to handle research and development projects. Essentially the laboratories consist of the Plant Control, Analytical, Research and Experimental Divisions. They specialize now in the control of components entering into the manufacture of aviation gasoline, meanwhile rendering a complete service in the



Portion of isomerization plant where normal butane is converted into isobutane.



DEPENDABLE

This battery of UNION HOV Centrifugal Pumps is typical of the rugged construction of all Union Pumps.

HOV pumps have many outstanding merits. Not only are they rugged in construction, but they are simple in design, making for easy inspection without dismantling the piping or disturbing the driver.

In addition to the HOV, Union builds a complete line of refinery pumps for every purpose. These include single and multi-stage Centrifugals for hot or cold service. They also build a complete line of Reciprocating pumps including Simplex and Duplex direct action steam pumps, and power driven pumps in Simplex, Duplex, Triplex and Quintriplex models, making a complete selection of reliable pumps on which industry has learned it can depend.

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UNION STEAM PUMP COMPANY

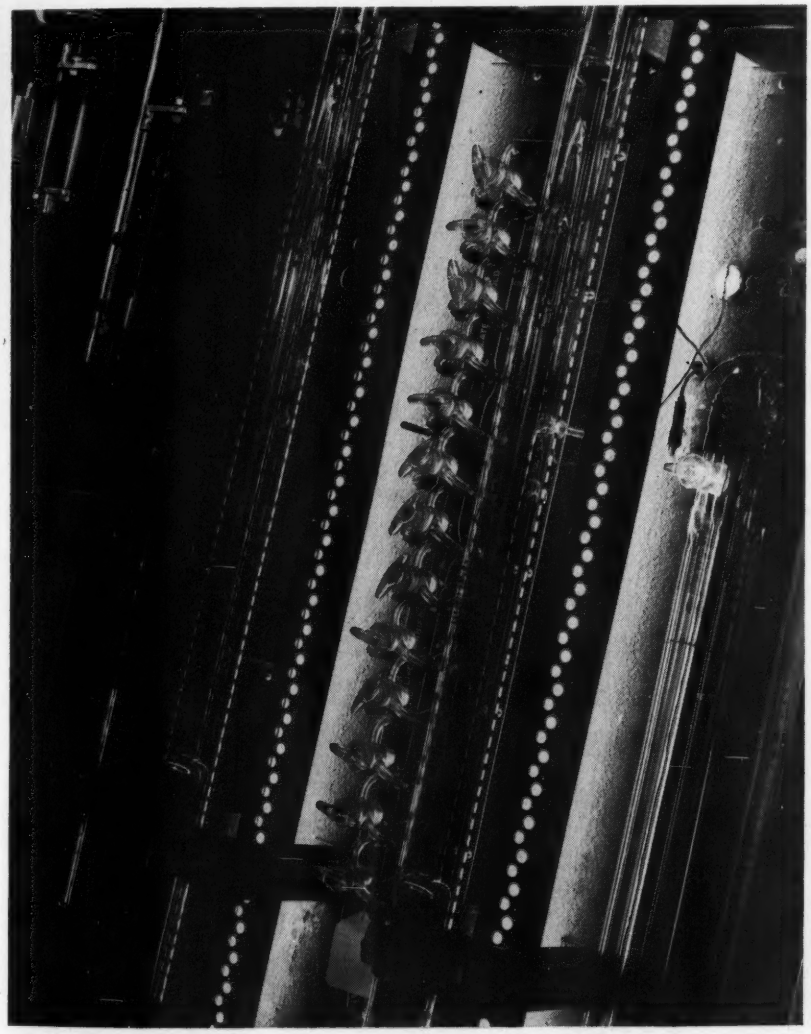
BATTLE CREEK, MICHIGAN

P. L. Armstrong, Sales Engineer, Los Angeles, Calif.

control of the manufacture of the many and varied products ranging from asphalts and lubricants to jet propulsion fuel and incendiary fluid. The laboratories are of service not only to the manufacturing department, but to the marine, pipe line, marketing and production departments. Miscellaneous technical investigations have been made for the U. S. Army, Navy and aircraft manufacturers and such work is also currently being pursued.

The laboratories are located in three buildings: the main building, the Engine Laboratory, located in the same area, and the Compound Laboratory located in the lubricating plant. The main building is a two stories-and-basement structure; it is U-shaped and is of reinforced concrete type of column and beam construction. Glazed tile partition walls are used throughout and may be removed or changed to any desired position as new demands arise. This building has 28,000 sq. ft. of floor space. Sound proofing devices are installed in all offices. All pipe lines are readily accessible; special ventilation is provided where required and each laboratory has fluorescent lighting. Electricity, distilled water, gas, vacuum and hot and cold water are supplied to each laboratory. All permanent furniture is made of birch, the sectional benches being covered with sheet lead or impregnated transite. Hoods are constructed of albarene stone and extra large flues have been provided.

C. K. Hewes, Chief Chemist

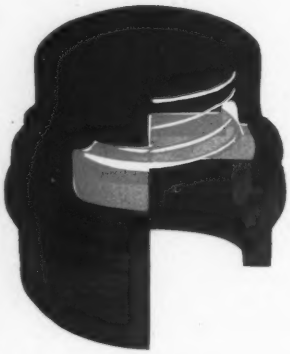


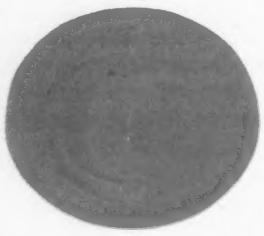
One of the six Podbielniak Hyd-Robots installed in the laboratory. The latest installation of this type is equipped with Helitronic controlled device.

The administrative and general offices are located on the second floor, together with the library, conference room, three analytical laboratories, crude assay laboratory, a photographic room, two research laboratories, a glassware washing room and change and rest rooms. On the first floor are the plant control laboratories which include the gas, asphalt, fuel oil, gasoline and sulfur laboratories. There is also a research laboratory, relating to gas analysis problems, and the experimental laboratory. The bottle washing room is equipped to handle 800 bottles per hour which are cleaned with solvent, fuming sulfuric acid, water, alkali and water, and finally dried in steam heated ovens. Retain-sample rooms and the cold room are adjacent to these control laboratories and bottle-wash room. Stock rooms are provided on each floor for various supplies and chemicals. In the basement are the electrical switch boards, refrigeration units and hot water tanks. Mechanical and electrical shops and glass blowing shops will be added for the maintenance of the laboratory equipment.

Engine Laboratory

The engine laboratory adjoins the main building but has been separated in order to eliminate vibrations and noise in the other laboratories. It has 2700 sq. ft. of floor space and is of the same type of construction





"CORROSION"

SUCCESSFULLY COMBATTED

EVCO pump valves are doing a tough job well at the recently completed Richfield 100-plus octane aviation gasoline refinery near Los Angeles.

The EVCO "H" type valve is used principally for High Pressure and for certain types of corrosive fluids that cannot be successfully handled by other types of valves. The disc is solid and can be faced many times. The "H" type valve can be furnished in any of the ferrous or non ferrous alloys; or, for unusual conditions, in special alloys developed by EVCO's engineering and research division.

EVCO "H" type valves will withstand a maximum discharge pressure of 1000 P.S.I.

EVCO "X" and "A" type valves, recommended where maximum discharge pressure is not above 500 P.S.I., have also been installed in the Richfield Aviation gasoline refinery.

EVCO patented valves are universal in their application to pumping problems and are suitable for use in any make of pump, horizontal or vertical, piston or plunger type.

For further information regarding EVCO valves, send for free catalogue.

ALFRED E. EVANS CO.
3175 Cherry Ave., Long Beach 7, Calif.

EVCO PRODUCTS

as the main buidling. Equipment is provided for the rating of aviation gasolines and motor fuels by the F2, F3, and F4 methods while cetane numbers of diesel fuels are determined by the ASTM-CFR Diesel Method. In the experimental engine laboratory additives for lubricating oils and for fuels will be evaluated in the Chevrolet and Caterpillar engines soon to be installed.

While an integral part of the main control laboratory, the compound laboratory is conveniently located in the lubricating and compound plant. It has approximately 1500 sq. ft. of floor space. It is well equipped with specially designed heating cabinets, cooling cabinets, kinematic viscosimeters with precision timing, and the general list of apparatus found in the better laboratories of this type.

The plant control laboratory daily evaluates large numbers of samples of both charging stocks and the products of the stills, and approves all shipments by trucks, tank cars and tankers. Two 4-bank electrically heated gas oil distillation units and five 6-bank electrically refrigerated gasoline distillation units are provided. The asphalt section carries out all routine testing and analyses of the many grades and types of asphalts, asphaltic emulsions and road oils manufactured. An Atlas Weather-O-Meter is used to correlate the weathering of the roofing asphalts. The sulfur section makes lamp sulfur determination on all light fractions; tests for mercaptans are made by a titrometric method; and sulfurs on heavy products are determined exclusively by the Shell combustion furnace method. The crude assay section evaluates all crudes as to their content of gasoline and heavier fractions, with the results shown as curves from which can be taken the physical characteristics and yields of any type of product desired to be segregated. Four Badger stills are employed, together with a specially designed high vacuum distillation unit. In connection with the T.C.C. unit no win operation, catalyst activity, carbon content and attrition tests are also made in this section.

The gas laboratory utilizes six Podbielniak Hyd-Robots, one of the latest being equipped with a Helitronic control device. This is essentially an electronic potentiometer, operating from a six point thermocouple junction. It establishes a gradient temperature in the overhead vapors and thus records much sharper breaks in the temperature curve of closely boiling compounds. The Hyd-Robots are operated in conjunction with two catalytic hydrogenation units and a McMillan anhydrous HCI apparatus. 36 inch and 72 inch Podbielniak Hyper Cal Units are used for the hydrocarbons boiling above the pentanes. A Bausch-Lomb Precision Refractometer and an infra red spectrophotometer complete the special equipment in this laboratory.

In addition to the innumerable chemical analyses relating to compounded lubricants, waters and chemicals used in the refinery, the Analytical Laboratory gives much attention to the analysis of aviation gasolines for content of lead, gums and stability. It is also responsible for all gas testing in the entire plant and recently trained and certified 42 men as competent gas testers in the various units in the refinery.

A laboratory devoted exclusively to the control of waste water has been set up. Since the refinery effluent flows into the Los Angeles harbor area, it has been necessary to check this effluent constantly to assure its being free from hydrogen sulfide, sodium salts, corrosive chemicals, oil and any other material considered deleterious to marine shipping, bird and fish life. This laboratory also supervises the recovery of slop oils in the refinery. A second water laboratory is located in the Boiler House and the raw, treated and blow-down waters are checked constantly by a staff of inspectors supplied by the plant control laboratory.

Several research laboratories are assigned to the correction of plant difficulties, the development of new products and by-products, the improvement of old products, and, under current conditions, the substitution of available materials for those that become unavailable. Some of these substitutions have greatly improved the products and will be used even when the other material again becomes available.

Experimental Laboratory

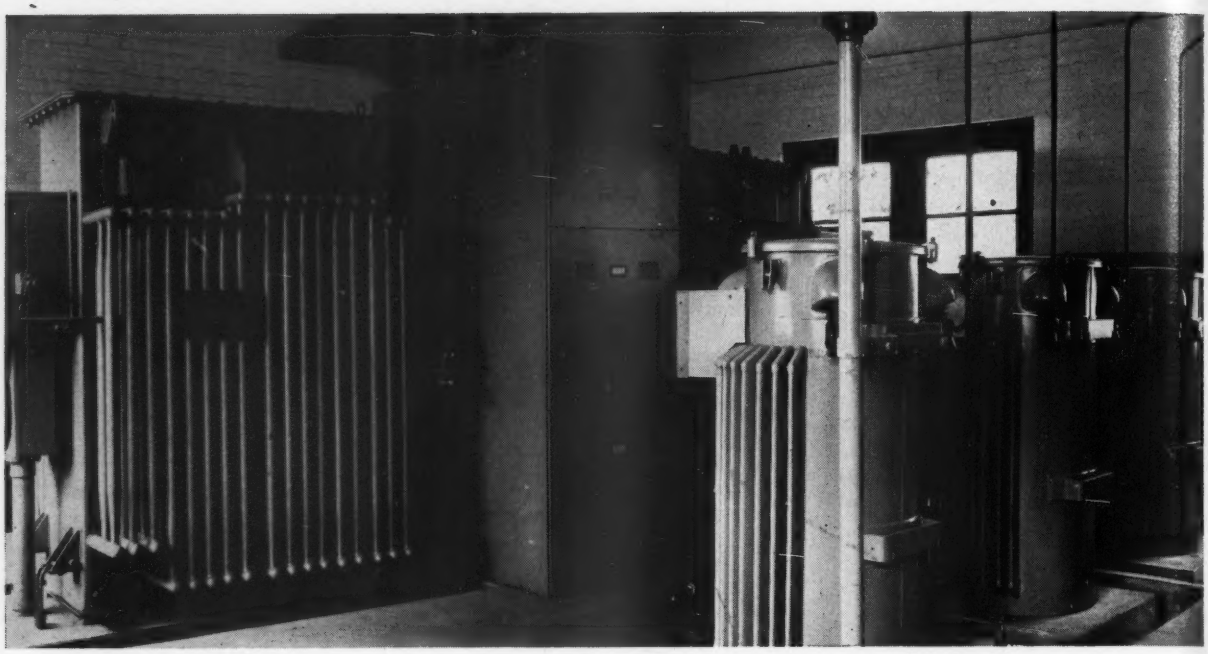
The experimental laboratory is equipped with a battery of steam and vacuum stills of various capacities, a 13-foot Stedman column, and miscellaneous grease manufacturing and testing units. A T.C.C. pilot plant is to be added soon. The experimental laboratory is adapted to provide on a pilot plant scale, special grades of gasolines, lubricating oils, asphaltic products and greases.

The refinery laboratories represent the latest in construction and they have been pronounced as rating with the best in the country. Other companies have sent their chemists and engineers to Watson to make a study of the many excellent features that have been incorporated in these laboratories.

POWER and LIGHT

By W. C. FARQUHAR

The additional power and light for the new units is purchased, as in the past from the Southern California Edison Company. The power company previously supplied power at 2300 volts on the secondary side of 11,000 volt transformers. In order to meet the additional demand, a rearrangement of the power supply has been made, and the power company now delivers at 11,000 volts to the main refinery substation and two other substations strategically located in the refinery area. The power company provides three sources of supply at 11,000 volts, with each supply line properly protected with relays so that trouble on one line



Portion of the General Electric installation for the new aviation gasoline units at Richfield.

will not interrupt the supply on the other two lines. The refinery has thus a high degree of protection against total power failure.

First to Install

Previous refinery loads were rated at 9200 KW. The load added by the new Thermofor Catalytic Cracking, alkylation, and fractionation units is 2800 KW, making a total of 12,000 KW. The old part of the refinery is still fed from the main transformer bank and distribution center by 2300 volt feeders of various sizes. The new load is distributed to the new units through three new substations. No. 1A substation is equipped with three 1000 KVA, 11,000 volt to 2300 volt, single phase, outdoor type transformers and the necessary switching equipment to receive the 11,000 volt power and distribute the 2300 volt power. This substation is fed from the main substation by No. 0000 lead-covered, underground cables carrying 11,000 volts. The 2300 volt power is carried from the No. 1A substation to the No. 18 substation for distribution through metal clad, vertical lift, switch-gear to the Thermofor Catalytic Cracking unit, the new addition to the alkylation plant, the old alkylation plant and the new steam boiler plant. A supply at 11,000 volts is also carried to No. 18 substation and is transferred there to 440 volt through two 400 KVA, 11,000 volt to 440 volt, three phase, indoor, metal-clad transformers. Distribution of the 440 volt power is made through a rebuilt open type 440 volt switch panel and lead-covered underground cables. In this same substation, provision is made for lighting the new units through three 100 KVA, 2300 volt to 120/240 volt, single phase transformers with suitable switching equipment. The 440 volt and 120/240 volt switching equipment is installed in a separate room from the 11,000 volt switching equipment.

The power and light supply for the new water cooling tower, pump house and water well is provided through No. 20 substation which houses two 300 KVA, 11,000 volt, three phase, indoor type, metal-clad transformers. The 440 volt power is distributed to the cooling tower fan motors, the well pump motor and other small motors through metal-clad switch-gear arranged in two sets of cabinets. Provision is made in this switch house for 15 KVA of 120/240 volt lighting transformer capacity to care for the lighting needs of the cooling tower, pump house, switch house and water well pump house. No. 20 substation is fed by a 11,000 volt, No. 0000 lead-covered cable from No. 1A substation.

Protection of all electric equipment has been given considerable attention. The 11,000 volt circuit breakers are 150,000 KVA interrupting capacity with D. C. solenoid closing and D. C. trip, while 2300 volt circuit breakers are 50,000 KVA interrupting capacity with D. C. solenoid closing and D. C. trip. All parallel primary feeders are protected by pilot wire relays. The secondary 440 volt equipment has 2,200 KVA circuit breakers and air break disconnects. The circuit breakers

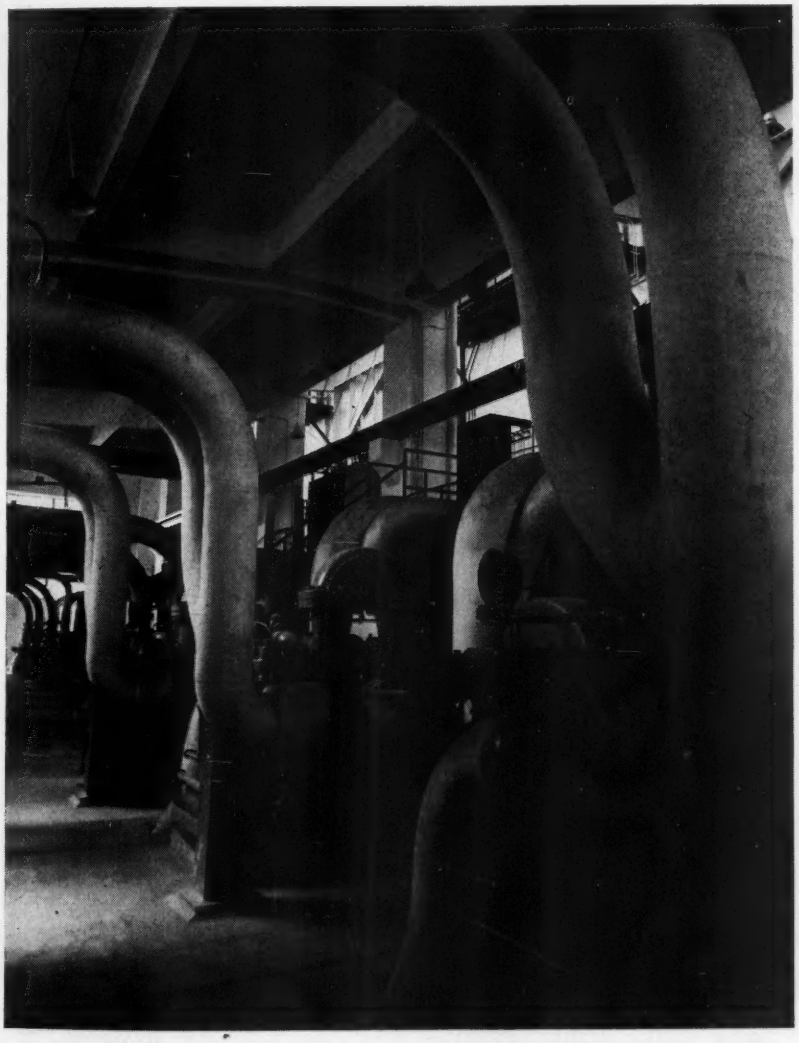
W. C. Farquhar, Refinery Manager.

are protected by current overload relays with D. C. tripping. D. C. current is supplied by suitable banks for storage batteries located in No. 1, No. 1A and No. 18 substations.

Power is distributed throughout the refinery in an underground system, using tile duct laid in concrete for the long runs, and black enamelled conduit for the short runs between manholes and switch houses. Conduit is also used for carrying cable in an operating area. All cables are lead-covered. Those for 11,000 volt are rated at 15,000 volt three conductor, compact sector, and shielded paper insulated, while those for 2300 volt service are rated at 5,000 volt, three conductor, compact sector and paper insulated. All secondary cables are rated at 600 volt, single conductor and varnish cambric insulated. The lead sheaths of the cables are grounded at each manhole through a No. 0000 bare cable which is installed in the concrete envelope below the tile duct and brought out at each manhole and terminated at each substation to a copper ground plate set at permanent ground water elevation.

All pumps, motors, tanks, pressure vessels, heat exchanger and structures are grounded to one common grounding system. At each substation, a water pipe ground has been provided. All switch-gear is connected to this water pipe ground as well as to the common ground above-mentioned.

With the demand for company products running at peak during the entire course of construction, it has been necessary to carry a considerable block of power on temporary lines while the switch-over and tie-in to the new substations have been made. Similarly, it has been found necessary to work some of the line changes "hot" in order to keep from shutting vital units down. This has required close cooperation between men, foremen and supervisors. It speaks well for this cooperation by all hands that no unit has been shut down involuntarily for electrical work.



Interior view of steam plant, showing Ingersoll Rand steam pumps.

THE NEW RICHFIELD STEAM PLANT

By G. C. LESLIE

As a preliminary to the design of the new steam plant, a study was made to determine the most economical steam pressure and temperature. Existing boiler plant steam pressure is 150 lb. psi. The new refining processes included reboilers and heaters that would either require steam at a pressure considerably over 150 lb. psi, or the construction of a heat medium heater. It was decided to use 600 lb. psi steam, 750° F. temperature, reducing to 450 lb. psi for the high temperature reboilers and 150 lbs. for all other uses. This is accomplished by using in 600 lb. psi turbines, exhausting into the 150 lb. system and any excess of 600 lb.

steam being bled through pressure reducing stations into the 150 lb. system.

Two Combustion Engineering Corporation Type VU boilers were installed, to produce steam at 600 lbs. psi and 750° F total temperature. Each boiler is equipped with two sets of air and flue gas equipment, i.e. two Ljungstrom air preheaters, two forced and two induced draft fans. The use of one set will permit the operation of the boiler at approximately 75% of the full load rating. This dual equipment permits the shutting down of one set of fans and air preheater for overhaul or inspection. In the meantime, the other boiler load would have to be increased 25% to make up the deficiency.

The boilers are equipped with Peabody combination gas and fuel oil burners, and for the present will operate on a block load while the old boiler plant will take the swings. The boilers are semi-enclosed and only the boiler fronts and the pumps are housed. The boilers themselves, together with the pressure reducing stations, fans and desuperheaters, are outside. There is a pressure reducing station for each boiler, each of which is large enough to take the total load. Both the pressure reducing stations and the desuperheaters are automatically controlled by Bailey instruments.

The plant was designed and built by The Lummus Company, and includes two innovations that will be appreciated by the operators. First, the steam piping is so arranged that all valves and regulators can be reached from the floor without the use of platforms or ladders. Second, all the pumps, with the exception of the boiler fuel oil pumps, are located in a straight line in the pump house, which extends across the front of the boilers. All boiler auxiliaries are driven by steam turbines. The boiler feed pump turbines are driven by 600 lb. steam and exhaust into the 150 lb. system. The other pump turbines using 150 lb. steam exhaust into the 25 lb. system. The high pressure steam headers from which the auxiliary pumps receive their steam are fed from both ends, and block valves are located between each take-off so that the valves and regulators to any pump can be isolated for overhaul.

The forced and induced fan turbines operate on 600 lb. steam and exhaust into the 150 lb. header, while the preheater turbines operate on 150 lb. steam and exhaust into the 15 lb. steam main leading to the softeners. All turbines are equipped with individual safety releases so that the turbines will be protected should the pressure in the 150 lb. system become dangerously high.

In addition to the boiler house auxiliaries, 600 lb. steam is used on 3200 H.P. of turbine drives on cooling tower circulating pumps, blowers, etc. These turbines exhaust into the 150 lb. refinery system. A large part of the exhaust steam is used for heating and processing, and is maintained at different pressures in different areas depending upon the temperature requirements of the individual processes. Accordingly, there is a 40 lb., a 30 lb. and a 25 lb. exhaust system. Should there be a deficiency of 25 lb. steam for feed water heating, there is a pilot-operated reducing valve to feed 150 lb. steam into the 25 lb. header. Two 12" Cochrane multiport relief valves are installed on the 25 lb. exhaust line to exhaust to the atmosphere should there be more exhaust steam than required.

The boiler blowdown goes through two flash tanks. From the first blowdown tank, the flash goes into the 150 lb. system, and from the second, the flash goes into the 25 lb. system. The steam trap installation is interesting to one familiar only with low pressure steam plants. Wherever the location of the lines permit, the traps from the 600 lb. header discharge into the 150 lb. header, the traps from the 150 lb. header discharge into the 25 lb. header, and the traps from the 25 lb. header discharge into the condensate return line.

Condensate Return

There are two condensate return systems. One system collects the return from all headers and traps operating on high pressure steam. This condensate is practically oil free and is returned to a 10,000 bbl. storage tank, and is used in the high pressure boilers. The second system collects the condensate from headers using 25 lb. exhaust, which

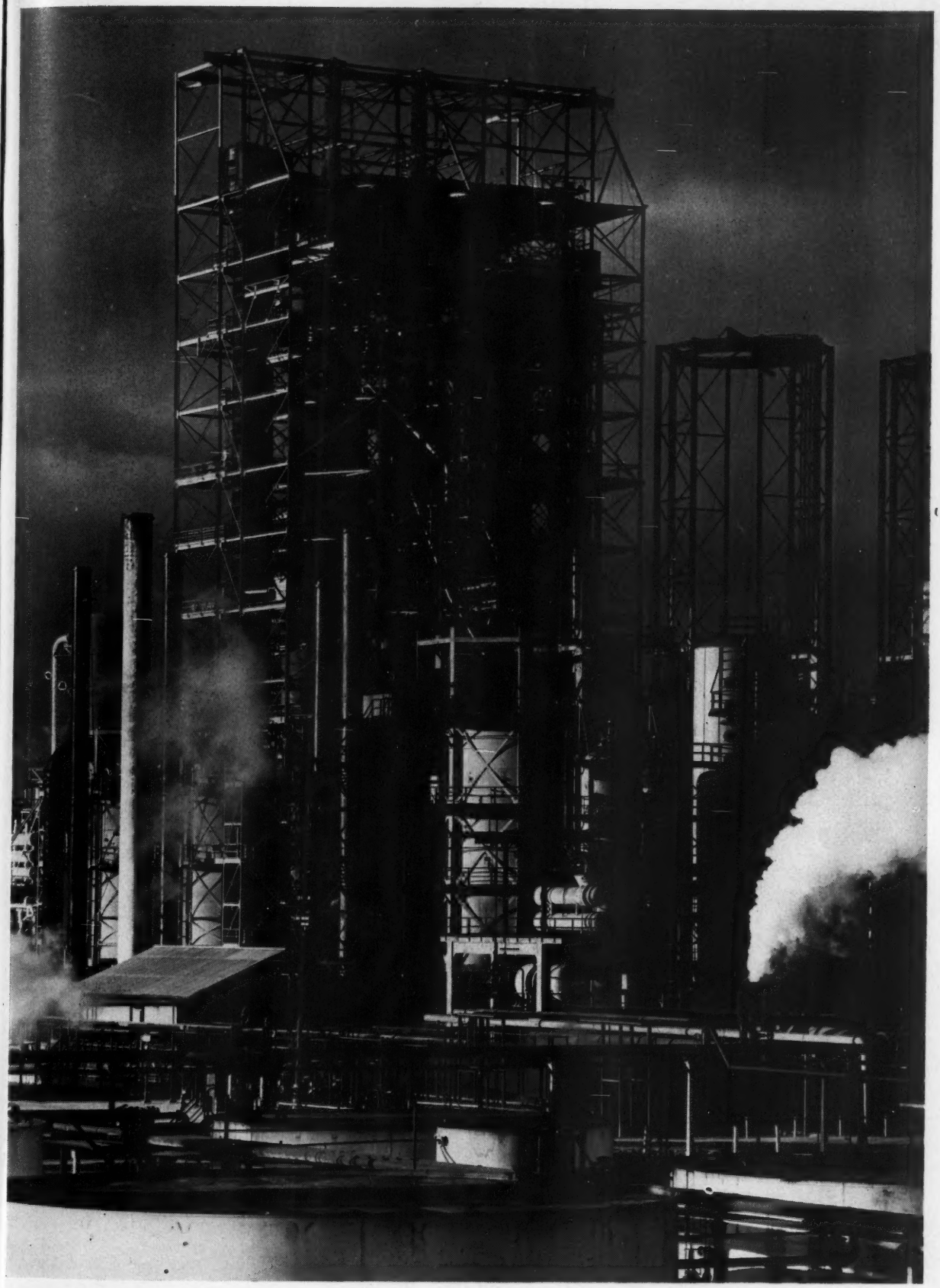
G. C. Leslie, Utility Foreman.

is obtained mainly from reciprocating pumps, contains considerable oil and is returned to the old boiler house where it is filtered through Loofah sponges before being fed to the low pressure boilers.

Water Treating

The water for boiler feed is low in hardness and low in dissolved solids except for sodium bicarbonate and silica, which are relatively high. The softening method consists of treatment with recirculated sludge and dolomitic lime-gypsum in a Cochrane hot process softener. The use of dolomitic lime and recirculation of sludge provides a high concentration of magnesium hydroxide, which removes silica by absorption. The silica is reduced from 30 ppm to 5 ppm.

Gypsum is added to reduce the alkalinity of the boiler water by converting the bicarbonate to sulfate, which does not hydrolize to give caustic soda. The amount of gypsum used may also be adjusted to give the required sulfate-carbonate ratio. The use of gypsum also has the advantage of precipitating the CO_2 which would otherwise be liberated with the steam and cause corrosion. Although the softener deaerating equipment is guaranteed to lower the oxygen to 0.005 cc/liter, sodium sulfite is injected into the boiler feed pump suction to make doubly sure that no oxygen will enter the boiler. The treated water



leaving the softener still contains 15 ppm of $CaCO_3$, and to remove this hardness, hexametaphosphate is added to give 40-50 ppm of PO_4 in the boiler blowdown.

The return condensate and raw well water are fed to separate compartments of the softener. The raw well water requires chemical treatment as well as deaeration, while the return condensate requires deaeration only.

Laboratory

A very complete water testing laboratory is located at one end of the chemical storage and mixing building. This laboratory is equipped to make all tests on raw and treated water, boiler blowdown and condensate. Also, all cooling water control will be directed from this laboratory.

Instrumentation

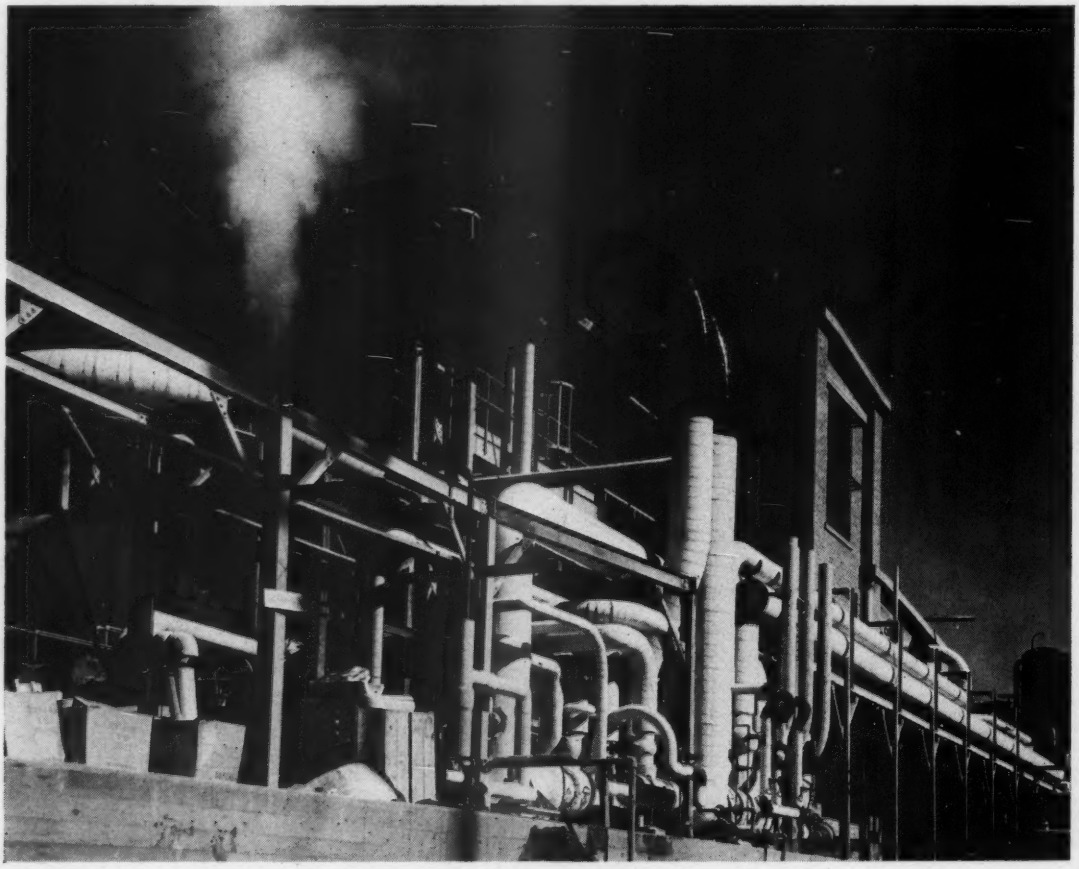
The pumps are controlled from the instrument board by means of Bailey instruments operating Mason Neilan motor valves. The motor valves are equipped with valve positioners and Powers bellows operate reverse acting trapping valves, which lock all motor valves should an air failure occur.

The fans and dampers are electrically operated by Leeds & Northrup push button controls.

Water Supply

The water supply for the refinery is obtained from wells located within the refinery. There were five producing wells before the expansion program, two more have since been drilled. The new wells have a capacity of approximately 1,700 gals/min. each. The water is of exceptional quality, having a hardness of only 3 gr. per gallon.

The wells all discharge into a reservoir adjacent to the fresh water pump house, from which three complete water systems leave. The high pressure system is maintained at 125 lbs. and is used only in case of fire or the testing of pressure vessels. The low pressure system is maintained at 65 lbs. by two pumps having a capacity of 2,800 gals/min. each. One pump is motor-driven, and runs continuously. The other is steam turbine-driven, and comes on automatically in case of power failure or whenever needed to maintain the required pressure. This low pressure water is used as make-up water to the cooling towers, for gland cooling and boiler feed, etc. The third system furnishes drinking water to the refinery, and is completely separated from the other two systems.



Exterior view of the new steam plant. Production capacity is in excess of 500,000 BTU's per hour.

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Field Development

Los Angeles Basin

Sunset Beach Try Abandoned

Standard Oil Co. Lomita Sunset Comm. No. 1 on sec. 29-5s11w at the southeasterly end of the Sunset Beach townsite is abandoning in shale and gray sand at 5803 ft. Drilled adjacent to an old location which produced a moderate amount of oil some 20 years ago, the unsuccessful try found only thin streaks of saturated sand in the objective zone, which were considered unworthy of production trial.

Whittier Area Well To Test

Mayo Oil Co. Grey No. 1 on sec. 17-2s11w in the Citrus Grove Heights area of the Whittier townsite is reaming to run 7 inch to 3310 ft. for a trial of Zone to the plug at 3390 ft. The total depth of the prospector is 4974 ft.

San Diego Co. Try Drilling

La Jolla Pet. Co. Well No. 1 on sec. 32-14s-3w in the Waterman Canyon area of San Diego County is drilling ahead in conglomerate at 3216 ft. after entering the zone at approximately 2820 ft. Progress here has been slow owing to the extremely hard formations encountered.

Brea-Olinda Field Limits Extended

Shell Oil Co., Inc. Puente B-1 in sec. 34-2s-10w has extended the producing limits of the field. Drilled as a deep outpost try at the northerly tip of the area the well bottomed at 5300 ft., where a 100 ft. interval tested wet, and plugged to 5080 ft. the well completed through 10 stages of perforations from 3592 ft. to the plug, pumping an initial 561 bbls. daily. Settled production was gauged at 474 bbls. of clean 23.4 gravity oil with an estimated 450,000 mcf of gas.

Buena Park Area Well Produces

Gen. Pet. Corp. Heath No. 1, sec. 34-3s-11w in Orange County, is producing from effective depth of 11,135 ft with 5½-inch casing cemented at 11,000 ft. Producing from the base of the Miocene after entering volcanic's at 11,305 ft. the well was last reported pumping 98 bbls. per day clean 28 gravity oil. On an adjacent well, originally drilled by Harrison M. Tucker, the company is cleaning out to deepen from 8935 ft. after finding a 13 inch casing at 1105 ft. in condition for a rework. To the southeast, and still southerly of the original Texas Co. production at Buena Park, Texaco is preparing to drill Kern No. 1 approximately 2500 ft. west and 100 ft. south of its abandoned Spencer No. 1 wildcat. The scheduled driller is located at the northwest corner of Dale and Page Streets on sec. 1-4s-11w.

Long Beach Deep Test Delayed

Shell Oil Company's projected deep test at the easterly end of the old Long Beach field is delayed by lost circulation. Located at 20th and Obispo Ave. the well, Alamitos No. 48 lost circulation at 5678 ft. and stuck drill pipe. With the fish recovered, surface casing was found bad, was repaired and the operator is currently attempting to regain circulation with cement below 2500 ft.

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Aliso Canyon	Standard Oil Co., Del Aliso	1	29, 3-16	8125	Drilling
	Standard Oil Co., Frew	1-3	29, 3-16	470	Drilling
	Standard Oil Co., Ward	3-1	27, 3-16	5300	Drilling
Castaic	Charter Oil Co., Well	1	18, 5-16		Graded roads
El Segundo	Richfield Oil Corp., Leuzinger	1	8, 3-14	3565	Drilling
Hasley Canyon	Shell Oil Co., Claiborne	88-4	4, 4-17	5743	Sidetracking
Las Llajas	Standard Oil Co., Brady Est.	2-1	13, 3-17	2461	Drilling
Newhall	British-Am. & The Texas Co., NLF	1	21, 4-17	4766	Drilling
	Standard Oil Co., N.L. & F.	3-2	19, 4-17	1565	Drilling
Pico Canyon	Standard Oil Co., Pico C. O.	42	1, 3-17	2646	Drilling
Puente	Alleghany Pet. Co., Rowland	1	14, 2-10	1186	Reaming
	Hacienda Oil Co., Well	1	27, 2-10		Location
	Hansen, Melvin, Corehole	3	24, 2-10	1900	Idle
Rosecrans	Wilshire Oil Co., Central Heights	1	28, 3-13		Grade
Seal Beach	Shell Oil Co., Bryant	2-1	3, 5-12		Rigging up
	Standard Oil Co., Std.-San Gabriel-Alamitos	1	3, 5-12		Foundation
Turnbull Canyon	Fowler Drilling Co., Saunders	1	13, 2-11	3465	Drilling
Whittier	Mayo Oil Co., Grey	1	17, 2-11	4974	Reaming
	Orange County				
Bolsa Chica	Standard Oil Co., Lomita-Sunset	1	29, 5-11	5803	Abandoned
Brea Canyon	Selbar Oil Co., Wardman-Comm.	1	3, 3-10		Rig
Buena Park	Gen. Pet. Corp., Heath	1	34, 3-11	11422	Completed
	Gen. Pet. Corp., Tucker	1	34, 3-11	8935	Prep. to deep.
	The Texas Co., Stern	1	1, 4-11		Location
E. Coyote	Barnsdall Oil Co., Sunny Hills	2	22, 3-10	6522	Perforating
Olive	Richfield Oil Corp., Hamrick-Olive	1	8, 4-9	2351	Drilling
	San Bernardino County				
Chino Hills	Chino Hills Oil Co., Kraemer	2	33, 3-28	350	Drilling
Hesperia	Salter, Lee, Well	1	34, 4-5	2906	Drilling
	San Diego County				
Waterman Cyn.	La Jolla Pet. Co., Well	1	32, 15-3	3216	Drilling

On "Out of the Way" Locations

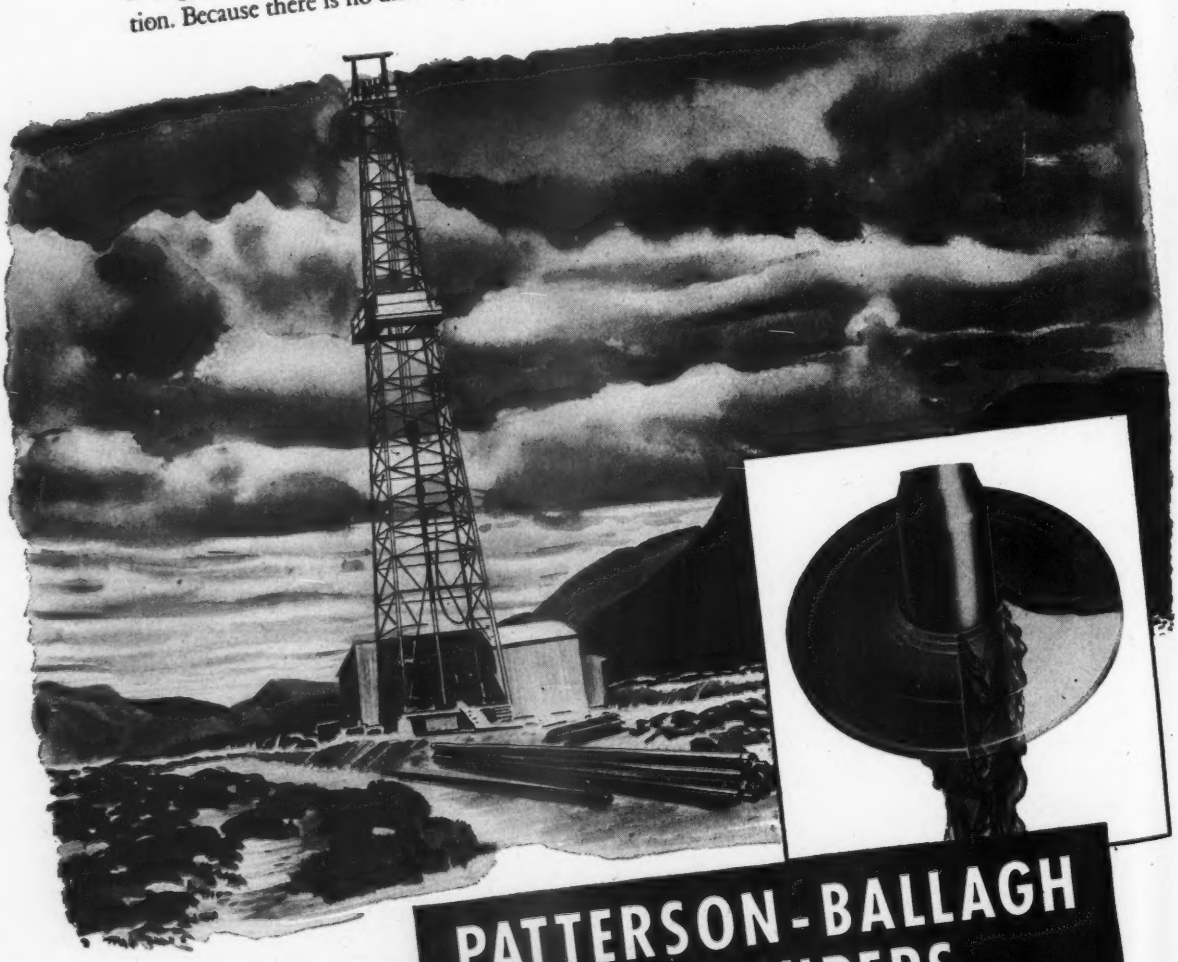
Patterson-Ballagh Pipe Wipers Save Time and Materials

No wash water required, less mud weight material needed. In "out of the way" locations, as in desert areas, the value of Patterson-Ballagh Pipe Wipers is even more apparent. With the installation of this equipment, mud or oil is cleaned off the pipe as it is pulled out of the hole. So completely is it removed that *no wash water is needed.* The saving of water in these areas is a real contribution. Because there is no dilution of the mud, extra weight material need not be added each trip. This advantage saves material and releases cargo space for other vital equipment. Here are benefits that can't be readily overlooked. And they aren't, for thousands of these Wipers are in service both in this country and overseas.

SEE COMPOSITE CATALOG

PATTERSON-BALLAGH

LOS ANGELES 1 • HOUSTON 10 • NEW YORK CITY 6



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NOW MADE OF PBX SYNTHETIC RUBBER, OIL AND WEATHER RESISTANT.

Seal Beach Field Work Continuing

Development of a good production established at Seal Beach continues at a rapid pace. Currently operating in this field are Capital Co., Continental Oil Co., Hellman Estate Shell Oil Co., Standard Oil Co., and Tide Water Assoc. Oil Co. With each company headed for the pay the week's most significant development was found in Standard Oil Co.'s San Gabriel No. 29 at the northeasterly field flank. Drilled as an outpost on an island in the slough area the well is standing with 7 inch cemented at 5897 ft. after a formation test from 4975 to 5897 ft. flowed an estimated 2300 bbls. gross rate, 29.7 gravity oil, cutting 16% salt water. This outpost production has prompted Standard to move northerly and drill S. O.-San Gabriel-Alamitos No. 1 as a bigger step into yet unproved territory. Also seeking extension between the indicated production and the Naval Hospital is Shell Oil Co., Inc.'s Bryant 2-1 which is rigging up for an immediate start. Each of the above mentioned outposts lies in the northerly part of sec. 3-5s-12w.

Athens-Rosecrans Work Continues

Activity in the old Athens-Rosecrans field is reaching a new high for an area once considered depleted. Southern Calif. Pet. Corp. Mahler No. 1 is gun perforating after redrilling and deepening to 6680 ft. in search of the recently discovered good production in this field. Across Broadway in the same area P. M. Girard has redrilled and deepened Russell No. 1 to 6870 ft. and is bailing for production after gun perforating 7 inch casing at intervals from 6130-6630 ft. To the South Union Oil Co. Howard Park No. 38 is pumping 135 bbls. daily 33 gravity oil from the interval 6520-6617 ft. The company will drill Rosecrans No. 49 as its next effort. New operations scheduled are a redrill of Reddish No. 12 at the northwest corner of 128th and Figueroa by Herley-Kelley and a deepening job on Athens No. 1 by J. R. Vaughn at 127th and Figueroa. In the southerly section of the joint field, So. Calif. Pet. Corp. is preparing to gun perforate and recomplete Slabaugh No. 1 in the Upper O'Dea zone.

Puente Well To Test

Alleghaney Pet. Corp. Rowland No. 1 on sec. 14-2s-10w is reaming to run 10¾ to the top of the oil zone at 1130 ft. after reaching a total depth of 1186 ft.

Turnbull Canyon Work Progressing

The Capital Co. continues its work in the Turnbull Canyon area of Los Angeles County. Latest completed in the new development was Well 2-2 near the easterly line of the Baldwin Ranch and Orange Grove Ave. in sec. 11-2s-11w. On a nearby location project No. 2-3 is bailing and swabbing for production after bottoming 1948 ft. The company is moving in to drill an outpost on the Andres Property which is Lot 49 of Tract No. 2421 at the north end of the field. This site is approximately 300 ft. north of the abandoned shallow Superior Oil Co. Andrews No. 1.

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San Joaquin Valley

Field Discovered at Sheep Springs

Rothschild Oil-Bender Oil Operations Sheep Springs No. 2 on sec. 17-29s-21e completed at 3487 ft. from 30 ft. of Carneros formation, flowing volumes reported as high as 750 to 900 bbls. per day. Average gauged production through an 8/64 in. bean has been 434 B/D 23.9 gravity oil, cutting only 0.1 to 4.5% and a small amount of gas under pressures of 240/900 lbs. The operators are immediately starting a drilling program to establish limits of this important discovery. Located southwest of the South Belridge field, the area is expected to attract the attention of many lease holders of surrounding acreage. First to announce plans for development here is Independent Exploration Co. which will drill Salt Creek No. 1 on the discovery section 17.

Trico Test Continues

H. H. Magee, Operator Amalgamated Happold No. 2, sec. 15-25s-24e off the southerly tip of the Trico field, was last reported coring ahead in undisclosed formation at 9600 ft. Little is known concerning the geologic findings in this well. Usually reliable sources report that the Olcese sands were wet in this hole.

Reserve Blowout Under Control

Reserve Oil & Gas Co. Well 33-7 in the Tejon Ranch area of the south end of San Joaquin Valley, which blew out while pulling tester on a water shut-off test at 2613 ft., was killed with water and squeezed with 800 sacks under 1500 lb. final pressure. The well bottomed at 2705 ft. in oil sand and set 7 inch at the top of the gas zone at 2610 ft. Cleaned out 3 ft. below the shoe, the well effected a normal shut-off and had recovered all but 13 doubles of drill pipe when the well blew in for a 5-day show of an estimated 15,000,000 cu. ft. daily. On the adjacent sec. 34, M. Metzenbaum is preparing to drill Well 34-4 at a location northwest of the center of the section. On section 15 of the township Richfield Oil Corp. is abandoning S. P. 10-15-15 at 7309 ft. after finding no significant showings.

Stratford Area Wildcat Planned

So. Calif. Pet. Corp. is planning to drill Socal Bergman No. 88-32 on sec. 32-19s-20e of Kings County. With Camay Drlg. Co. as contractors, the well will be put down 330 ft. north and 330 ft. west of the southeast corner of the section.

Burrel Area "Cat" Abandoned

Gen. Pet. Corp. Cryant No. 1-32, which sought an accumulation on sec. 32-16s-19e 2½ miles east of Burrel production, abandoned in gray sand and siltstone at 8142 ft. without having reported showings. The company is rigging up Burrel 8-26 on sec. 26-16s-18e in the hope of extending production to the north.

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
Fresno County					
Burrel	General Pet. Corp., Burrel	8-6	26, 16-18		Rigging up
	General Pet. Corp., Cryan	1-32	32, 16-19	8142	Abandoned
Cantua	Tide Water Assoc. Oil Co., S.P.	82-15	15, 17-15		Cellar
Jacalitos	Standard Oil Co., Well	85-17E	17, 21-15	2530	Drilling
	The Texas Co., Hawxhurst	1-6	6, 22-16	4857	Abandoned
NW Raisin City	Seaboard Oil Co., Seaboard-Pure	5-5	5, 15-17		Rigging up
San Joaquin	Superior Oil Co., San Joaquin	88-32	32, 15-17	7310	Abandoning
S. E. Helm	Amerada Pet. Corp., Calif. Lands	76-15	15, 17-18	8091	Testing
Tranquility	Standard Oil Co., Patterson	74	3, 16-14		Location
	The Texas Co., Calif.-Cotton	36-23	23, 16-15		Rig
Kern County					
Ant Hill	Amerada Pet. Corp., S. P.	37-15	15, 29-29	2212	Rig pump
Canfield Ranch	Shell Oil Co., Inc., KCL-B	45-27	27, 30-26		Rigging up
Devils Den	C.C.M.O. Co., Bates	2	20, 25-19	3860	Drilling
	Hillview Oil Co., Hillview	2	11, 25-18	173	Drilling
E. Edison	Richfield Oil Corp., Cottonwood-Olcese	1	20, 29-30		Rigged—Idle
Fruitvale	General Pet. Corp., KCL	76-29	29, 29-27	4626	Drilling
	General Pet. Corp., Kernlandia	84-16	16, 29-27		Rigging up
Gosford	T. W. A. Oil Co., KCL	66-22	22, 30-26	7546	Drilling
McKittrick	Americal Pet. Corp., Americal	1	2, 30-31	5450	Idle
	MacDonald-Burns & Norris, Flickinger	1	36, 30-22	5147	Testing
	Richfield Oil Corp., Olig	3	12, 30-21	1546	Abandoned
	Standard Oil Co., McPhee	2-1	36, 29-21	5360	Drilling
Lindsey Hills	Standard Oil Co., Notz	1	18, 28-22	1516	Drilling
Lost Hills	Standard Oil Co., Cahn	58-4	4, 27-21		Foundation
Magunden	Western Gulf Oil Co., Cohn Est.	1	3, 30-28		Rigging up
McClung	Continental Oil Co., KCL-G	2	4, 30-26	3894	Drilling
McVan	Butler Bros., Well	2	14, 27-27	1080	Drilling
Poso Creek	Independent Expl. Co., Conoco	23	33, 27-27		Rigging up
Round Mt.	Bender Drilling Co., Vedder	14-1	14, 28-28	2150	Drilling
	Gen. Pet. Corp., Larkins	1	10, 28-28		Grade
	T. W. A. Oil Co., Olcese	1	27, 28-29	1501	Drilling
Semitropic	Standard Oil Co., Fullerton	1	25, 27-23	13018	Drilling
Shafter	T.W.A. Oil Co., Shafter Comm.	86-A7	7, 28-25	12533	Drilling
Sheep Springs	Rothschild-Bender, S. S.	2	17, 29-21	3487	Completed
So. Belridge	Bandini Pet. Co., Bacon	1	27, 28-20	9541	Drilling
Strand	Standard Oil Co., Robbins	25-35			Rigging up
	Standard Oil Co., Borland-Olney	67-35	35, 29-26	8600	Suspended
	Standard Oil Co., Brittain	61-2	2, 30-26	9953	Drilling
	Standard Oil Co., KCL	23-41	6, 30-26		Foundation
	Superior Oil Co., Houghton	38-35	35, 29-26	7950	Reaming
Stockdale	W.G.O. Co., KCL	77-5	5, 30-27	11675	Drilling
Sunset	T. W. A. Co., McBean	86-36	36, 12-23	8987	Drilling
Tejon	M. Metzenbaum, Well	34-4	34, 11-19		Location
	Reserve Oil and Gas Co., Well	33-7	33, 11-19	2705	Stdg. cem.
	Richfield Oil Corp., S. P. 10	15-15	15, 11-19	7309	Abandoning
Trico	Magee, H.H., Opr., Amal-Happold	2	15, 25-24	9600	Drilling
Kings County					
Stratford	So. Calif. Pet. Corp., Socal-Bergman	88-32	32, 19-20		Location
Pyramid Hills	Standard Oil Co., Well	1-6	21, 24-18	3542	Abandoned
San Luis Obispo County					
Midway	C.C.M.O. Co., Well	G-3	2, 32-22	2813	Bailing
	Richfield Oil Corp., Temblor Hills	1-1	36, 31-21	5497	Fishing
Tulare County					
Ducor	Tannehill, L. B. & Assoc., Hunsaker	1	17, 23-27	2330	Abandoned

Buena Vista Well Completes

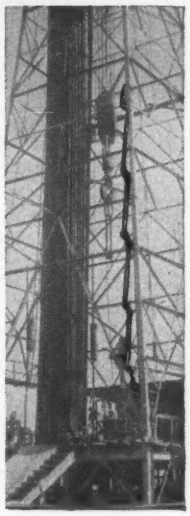
Honolulu Oil Corp. completed Caribou No. 28-87 sec. 28-31s-23e at an effective depth of 4560 ft., flowing 649 bbls. of clean 30 gravity oil through 20/64 inch bean. The company is drilling Well No. 108 on sec. 6,32s-24e at 561 ft. Murvale Oil Co. has resumed work on the Columbus lease, sec. 28 31s-23e with No. 2A drilling below 600 ft. Standard Oil Co.'s most recent completion in this field was No. 332-35B which completed at 4045 ft. flowing 675 B/D, 29.6 gravity oil and 240 mcf gas through 20/64 inch bean. The company has resumed work on the McNee property, sec. 36-31s-23e, with No. 347 drilling below 487 ft. and foundation poured for No. 308.

Standard Breaks Calif. Depth Record

Standard Oil Co. of California's KCL No. 20-13, on sec. 5-31s-25e in the Coles Levee field, has explored to 15,009 ft. to break the California drilling record by 5 ft. Deepest prior hole was Continental Oil Company's 15,004 ft. KCL No. A-2 at Wasco. The current well is prospecting ahead in search of geologic horizons which have produced on the East side of the Valley. Indicative of difficulties in drilling below 15,000 ft. is the fact that it requires a full eight hours to come out of the hole, change bits and re-enter to bottom. Standard's record-breaker now becomes a contender for the world's record drilled depth of 15,279 ft. which was achieved by a wildcat in Pecos County, Texas.

McKittrick Well Large Gasser

MacDonald, Burns & Norris' Flickinger No. 1, in sec. 36, 30s-22e, in the east McKittrick area, was bottomed at 5147 ft. and landed 7 inch casing, including 68 ft. of perforations at 5044 ft., cp'd at 4981 ft. and on test produced sixteen million cubic feet of gas. After a 24 hour test the well was shut in. This well has every earmark of a major discovery.



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Southeast Helm Data Withheld

Amerada Pet. Corp. Calif. Lands 76-15, sec. 15-17s-18e, is reported bottomed at 8091 ft. in oil sand. At press time, little data was available concerning the amount of quality of sands encountered.

In the Helm field, Amerada has completed Schultz No. 26-36 at 8288 ft. and Gunn 34-35 at 8216 ft. for yet unrevealed rates. The company's Clover 53-28 on sec. 28, 16s-17e is drilling ahead in sandy shale at 7135 ft. On sec. 9, 17s-18e Gen. Pet. Corp. Noble F-44-9 was completed at 8278 ft., flowing at a 200 bbl. rate of clean 31 gravity oil through a 20/64 inch bean. On sec. 5 of the township Noble 67-5 is drilling at the 6000 ft. mark.

Elk Hills Wells Make Good Rates

Completions in the Elk Hills field remain consistently high with rates varying from 300 to 600 bbls. per day. The operator for U. S. Navy, Standard Oil Company of Calif., is making large strides for the eventual 300 producers with an average of 15 strings of tools at work.

Cymric Work Progresses

Superior Oil Co. continues development of the Cymric field in Kern County with two wells completing, several staked ahead and Weston No. 8 just turned to the tanks pumping 75 B/D 13 gravity clean oil from 1417 ft. Victory Oil Co. is preparing to immediately resume drilling within the field and has staked Wells No. 24, 25 and 26.

Edison Area Gets Discovery

The joint British-American-Capital Co. Portals No. 53-3, on sec. 3-30s-29e east of North Edison production, effected discovery at 4768 ft. With 36 ft. of perforation open to formation, the well initialled 240 B/D, 37.8 gravity oil cutting 2.0% through a ½ inch bean for 15 hours and a 1½ inch open line for 9 hours. Late production through a ½ inch bean was 90 B/D oil and 120,000 cu. ft. of gas. The operators are preparing to drill No. 43-3 on a nearby site.

Coastal and Northern District

Rincon Driller Starting Work

At the westerly end of the Rincon field in Ventura County, in what is known as the Mussel Shoals, Beloil Corp., Ltd. has built rig for Hickey No. 1. The operating company is a joint holder, with Lido Pet. Co. and O. C. Field Gasoline Corp., of a 667 acre State tideland lease. Approximate location of the rig is 50 ft. north and 400 ft. east of the w¼ cor. of sec. 7-3n-24w.

Ojai Well Scheduled

L. E. Ellington is rigging up to drill a well approximately 875 ft. south and 1050 ft. west of the E¼ cor. of sec. 8-4n-21w. Drilled under contract by O'Quinn and Hadley the well will seek shallow production normal to the adjacent pools.

Camarillo Area to Get Driller

D. A. Barth is preparing to drill Well No. 1 on sec. 32-2n-20w in the Camarillo Area of Ventura County. The well is located 160 ft. northerly and 1450 westerly from the most easterly corner of Lot 17 of Rancho Calleguas.

Elwood Gasser to Produce

Signal Oil & Gas Co.'s State No. 129-2 which blew out and ignited at 5450 ft. after cementing 8⅝ inch casing at 4973 ft. is killed and preparations are under way to complete the well barefoot. Killed with water through a hat tap at the top of 8⅝ inch casing, the earlier fire was the most spectacular of recent years. Estimates of volume during the conflagration were 300 to 500 bbls. of oil and 25,000,000 cu. ft. of gas daily.

Cat Canyon Well Produces

Pac. Western Oil Corp. completed Los Alamos No. 21, on sec. 36-9n-33w at Cat Canyon, at a total depth of 5690 ft. pumping barefoot from the shoe of 7 inch at 5150 ft. at a 352 bbl. per day rate of clean 15 gravity oil. The company is drilling No. 27 on the adjacent section 1-8n-33w at 1719 ft. Union Oil Co.'s current operations in this field center on the Palmer-Stendel holdings. No. B-1 on sec. 26-9n-33w is drilling at 4393 ft. while No. A-1- on sec. 29-9n-32w is rigging up. At an outpost location on sec. 10-8n-33w Richfield Oil Corp. Los Flores No. 1 is swabbing and testing from the 6580-6858 ft. interval The total depth of the outpost is 7267 ft. in shale.

Goleta Test Makes Flow

Pac. Lighting Corp. Miller No. 1, a Vaqueros zone test on Mascalitan Island in sec. 20-4n-28w, is running 8⅝ inch casing to bottom at 4214 ft. after a formation test of the interval below 4146 ft. blew an estimated 9,000,000 mcf of gas per day.

Work Resumes at Orcutt

Union Oil Co. is laying ground work for Cal-Coast No. 20 on sec. 26-9n-34w in the old Orcutt field of Santa Barbara County. Location for the new well is 1500 ft. south and 2400 ft. west of the northeast corner of the lease.

Ventura Ave. Well Produces

Shell Oil Co., Inc., continues its solid production record in the Ventura Avenue field . The latest to the tanks was Taylor No. 182 which finished at 8010 ft. flowing from perforations below 7620 ft. Settled production through a 2 inch open line was 834 bbls. of clean 31.6 gravity oil and 545,000 mcf of gas. Shell is operating 4 strings in this field while Tide Water Assoc. Oil Co. is

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
	Santa Barbara County				
Cat Canyon	Richfield Oil Corp., Los Flores	1	10, 8-33	7267	Testing
	Union Oil Co., McNee, C. H.	3	20, 9-32	4500	Testing
	Union Oil Co., Santa Maria Realty	1	10, 9-33	3886	Drilling
Gaviota	Standard Oil Co., Hollister	1	35, 5-33		Rig
Lompoc	S. R. Williams, Fickert	1	8, 7-33	3446	Idle
Los Alamos	J. I. Anderson & So. Calif. Pet. Corp., Archambeault	2	3, 7-32	5126	Drilling
Los Olivos	Hub Oil Co., La Laguna	1	7, 7-30	3580	Idle
Purisima	Whittier Assoc., Barham	2	11, 7-32	3726	Testing
	Ventura County				
Camarillo	Barth, D. A., Well	1	32, 2-20		Location
Ex-Mission	Union Oil Co., Adams	41	19, 4-21	3061	Abandoned
	Union Oil Co., Adams	42	19, 4-21	1366	Drilling
Happy Camp	Cal-Camp Oil Corp., Harrington	1	21, 3-19		Grade roads
Oxnard	Lloyd Corp., Ltd., Todd	A-1	6, 1-22		Rig
Sespe	Assoc. Pip. & Eng. Co., A.P.&E. Co.	1	5, 5-19		Rigging up
	Volunteer Pet. Co., Tar Creek	3	28, 5-19	2373	Reaming
	Merchants Pet. Co., Well	9	1, 4-20	160	Drilling
South Mt.	Los Nietos Co., L.B.H.	1	22, 3-21	2631	Drilling
	Pac. West. O. Corp., Yale-Richardson	2	13, 3-21	2735	Drilling
	Wilshire Oil Co., Petit	2	16, 3-20		Rig
Timber Canyon	Hickey, Noble J. Temple	1	22, 4-21	717	Drilling
	San Luis Obispo County				
Arroyo Grande	McDuffie, Wm. C. Adams	1	31. 31-13	3832	Rigging pump

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Butte	Pacific Western & Getty Greenlee	1	25, 19n-2e	1466	Drilling
	Richfield Oil Corp., Hamilton-Nord	1	9, 22n-1w	5230	Abandoning
Colusa	Standard Oil Co., Davis	1	36, 18n-2w		Location
Contra Costa	Shell Oil Co., Inc., Jacuzzi	1	34, 2n-2e		Location
Glenn	Standard Oil Co., Torres	1	12, 18n-2w	2980	Drilling
San Benito	Panoche Pet. Co., Panoche	1	24, 16s-10e	843	Idle
San Mateo	Richfield Oil Corp., Lena Souza	1	13, 7s-5w	5211	Testing
Solano	Amerada Pet. Corp., Sorensen	1	19, 6n-3e	3990	Drilling
	Shell Oil Co., Lambie	1	25, 4n-1w	2617	Stdg. plug.
	Shell Oil Co., Lambie	1A	25, 4n-1w		Cellar
	Standard Oil Co., Suisun	3	5, 3n-1w	5645	Drilling
	Standard Oil Co., Suisun	4	5, 3n-1w	4204	Drilling
	Standard Oil Co., Fontana	1	23, 3n-1w	7944	Drilling
	Standard Oil Co., Fontana	2	32, 4n-1w	3142	Drilling
Tehama	Superior Oil Co., Saldubehere	1	12, 24s-3w	9062	Drilling
	The Texas Co., Jelly-Bend	18-8	8, 29n-2w	3730	Drilling
Yolo	The Texas Co., Winchester	8-1	4, 6n-4e		Location

currently running 5 strings. At the north flank of the field, Lloyd Corp. Ltd. No. 14 is drilling ahead at 8700 ft. while British Amer. Oil Prod. Co. Hartman No. 15 is drilling in the grass roots at 376 ft.

Gato Ridge Work Resuming

The Petrol Corp. is preparing to drill Magenheimer No. 6-16 on sec. 8-8n-32w while Barnsdall Oil Co. is preparing to resume work on its holdings in this field.

Two Drill at Bardsdale

Wilshire Oil Co., Inc. C. E. Dryden No. 1, deep test on sec. 7-3n-19w, is prospecting ahead at 4805 ft. Good oil sands were reported in the 1800-1900 ft. interval and approximately 300 ft. of saturation between 1200 and 1800 ft. No formation data has been available below this point. In the same section, San Marino Oil Co. Capital Crude No. 2, is drilling at 516 ft.

Purisima Hills Test Plugging

Whittier Associates Barham No. 2 on sec. 11-7n-32w is plugging up hole by stages after recovering only water on pump test above 3600 ft. A shallow zone at 2724 ft. produced a small amount of oil on the way to the well's total depth of 2726 ft.

Sespe Wildcat Ready to Spud

Associated Piping & Engr. Co. is preparing to drill a well on sec. 5-5n-19w in the Squaw Flats, or north Sespe area. At last report, the bulk of the equipment was in place and a spud was momentarily expected.

Timber Canyon Well Working

Noble J. Hickey has resumed work on the 656 ft. Hardison and Temple No. 1 in sec. 22-4n-21w. When last reported the well had cleaned out and was making new hole at 717 ft.

York Plans Placerita Well

Victor H. York, well known oldtimer in the California oil industry, is preparing to drill a well in the Placerita Canyon area of Ventura County. Work is expected to start in the immediate future.

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ANNOUNCEMENT OF A NEW SPECIAL MONTHLY FEATURE

Beginning with the second issue in November the "California Oil World" will carry a monthly statistical review. The data will be presented in tabular form for quick, easy reference and will cover development, exploitation, total raw material supply, total demand, and total stocks on hand. The report will be available to readers of the "California Oil World" as soon as total industry data are compiled.

The development and exploitation section will include all California oil fields. It will show the number of active drilling wells, new oil wells completed and their total initial production, as well as the average daily production.

The Supply and Demand section will give a seven year review of total raw material supply, total refined products available, and total demand for all products in the Pacific Coast Territory. The data will be reported for the same month each year thus enabling the reader to make a direct comparison with the same period in previous years.

In addition the tables will be supported by a curve showing the current production with that of the previous year.

The "California Oil World" feels confident that the review will be useful to all men affiliated with the petroleum industry. The form and material content of the tables are designed to give a complete running picture of the petroleum situation in the Pacific Coast Territory. All data is compiled from reliable sources. The tables were arranged by a petroleum analyst and a petroleum engineer.

Northern Calif. Gas Area Active

Interest in the gas producing areas of Northern California, particularly that surrounding Rio Vista in Sacramento and Solano counties, proceeds at a high pace. With geological parties constantly at work and an intensive leasing program under way the area earns the name of California's "hot spot." According to current scout reports and wildcat tabulations, much drilling will be done in the areas lying between the rich Rio Vista field and other smaller but prolific productive areas within a thirty to forty mile radius. While much development work has been done in this general area there are many promising structures as yet untried.

South Belridge Test Continues

Bandini Pet. Co. Bacon No. 1 deep test on sec. 27-28s-20e in the So. Belridge area of Kern County is spot coring ahead at 9541 ft. in fine tight sand with occasional stains and cuts. The Top of the saturated zone was placed at approximately 9425 ft.

Midway Well Finishes

Standard Oil Co. completed Well No. 83-29D on sec. 29-32s-24e at 3435 ft., flowing 226 B/D, clean 23.1 gravity oil and 110 mcf gas through 24/64 inch bean. The company has skidded rig approximately 650 ft. to the south and is rigging up for an immediate start on Well No. 84. On section 4, 32s-23e Univ. Cons. Oil Co. Doyle No. 1 failed to produce commercially at 4113 ft. and deepened to 5004 ft. in shale and abandoned without further trial.

Hopper Canyon Well to Deepen

Dodge, Inc. is preparing to deepen the old Signal Pet. Co. of Calif. Well No. 7 on sec. 13, 4n-19w at Hopper Canyon. The project proposes to test the Lower Miocene at an estimated depth of 5000 ft.

Yorba Linda Well Started

Crown Pet. Co. has rigged up for Page No. 1 southeast of the intersection of Wabash Ave. and Rose Dr. on sec. 17-3s-9w between the Yorba Linda-Richfield fields.

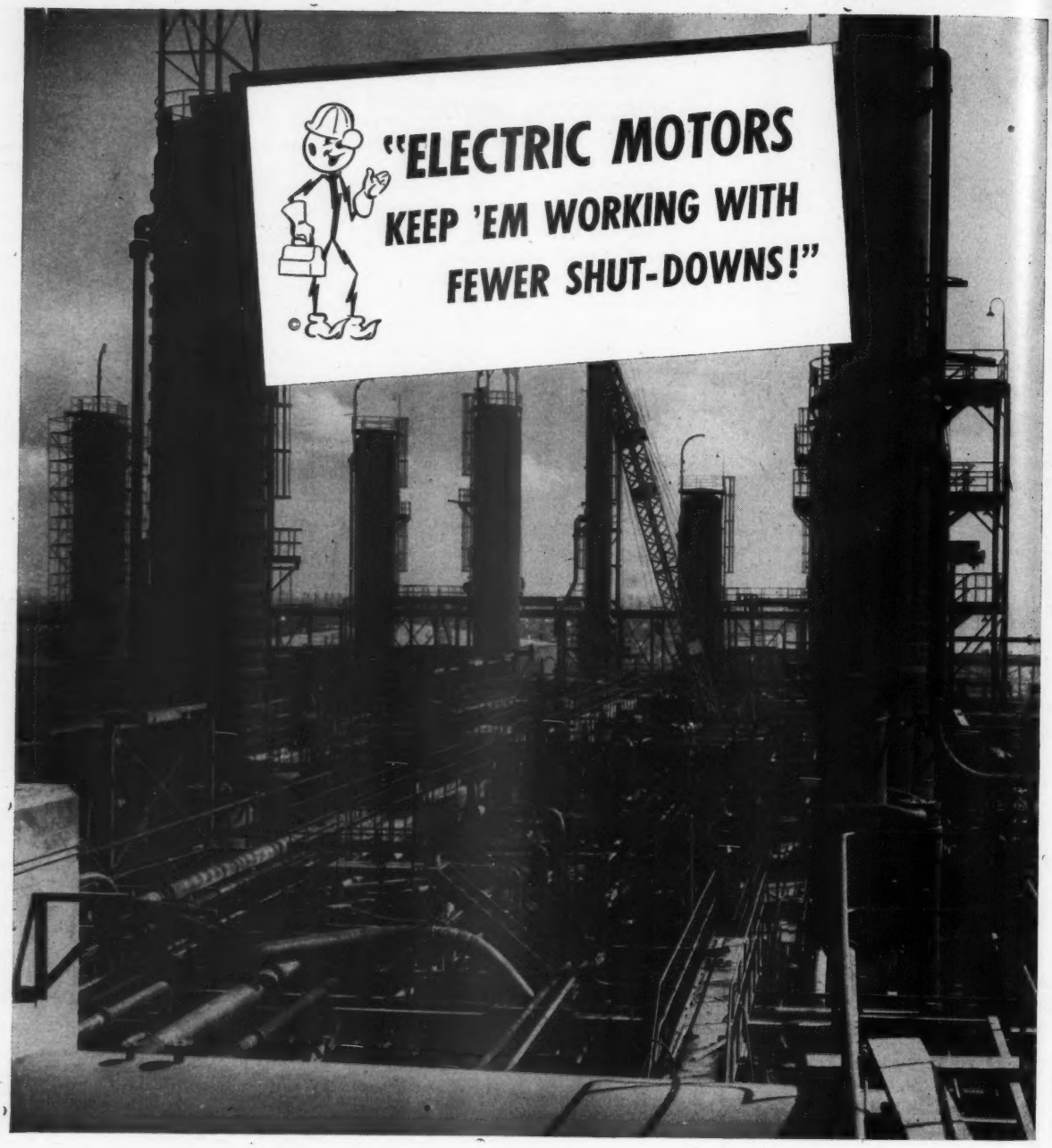


Photo courtesy of Union Oil Company of Calif.

The shortage of manpower, harder usage of equipment and scarcity of replacement parts makes it more important than ever to avoid shut-downs at refinery, pipeline or well. When electric power is used, shut-downs are reduced to a minimum! The electric motor's smooth, continuous operation causes little wear on equipment and often steps up production. Valuable manhours are saved in maintenance, making repairs and securing replacement parts.

These advantages, plus electric power's great dependability and efficiency, are important factors in enabling many operators to maintain production schedules in spite of wartime difficulties. Installation, maintenance and operating costs are low for electric motors. Talk with an Edison oil field engineer now about electric power for your needs. He will gladly give you all facts, with no obligation to you.

SOUTHERN CALIFORNIA EDISON COMPANY LTD.

THIS LAUGH

OFF!!

"How did you learn to kiss like that?"

"Siphoning gas."

A forest ranger in Arizona frequently saw an Indian chief riding his horse up the canyon trail, his wife trudging along behind him.

"Why is it?" the ranger asked one day, "that you always ride and your wife walks?"

"Because," was the solemn reply, "she no gottum horse."

Theater Manager: "The fire was in the leading lady's dressing room. The firemen were there six hours."

Reporter: "Six hours to put out a fire?"

T.M.: "One hour to put out the fire and five hours to put out the firemen."

"Is my husband at the club?"

"No, ma'am."

"But I haven't told you who I am."

"Dere ain't no woman's husband at de club. No, ma'am nevah!"

"My wife and I had an argument and she went home to her folks in Maine."

"Bangor?"

"I didn't even touch her."

"This food tastes terrible. Did you salt it?"

"Yes'm, but I never used that brand before. It was called Epsom Salts."

"My feet burn like blazes. Do you think a mustard bath would help?"

"Sure! There's nothing like a little mustard on hot dogs."

"I hope the color of that blouse won't fade when it is washed."

"Oh, it is as safe as the bloom on your cheek."

"Oh, well, then—won't you show me something else?"

A policeman came along and said: "What's the idea? Move along."

"Sh, s-sh," said the drunk. "This ish where I live."

"Then why don't you go in?"

"Losh my key."

"Why don't you ring the bell?"

"I rang it an hour ago."

"Then ring it again."

"Ta hell with 'em. Let 'em wait."

"It was at least ten feet long. I never saw such a fish in my life."

"That I can believe."

The editors of a certain magazine recently received from a Latin-American subscriber a letter written in the language of the subscriber's country. The communication had been translated for the editors but had apparently suffered from a literal translation of the part which read:

"I am needing a male water sheep. Please tell me where I could find one."

After much head scratching, one of the editors suddenly realized that the thing made sense after all. The inquirer wanted a hydraulic ram!

We always called a spade a spade until we hit our foot with one the other day.

"You never remember our wedding anniversary."

"I do, distinctly. According to your present age, it occurred when you were 3 years old."

"They say that in Mexico you can get three pounds of sugar, a pound of coffee, a quart of whiskey and a wife for three dollars."

"I bet it's rotten whiskey."

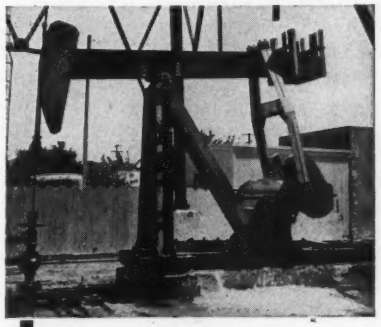
"I had to change my seat several times in the movies."

"Gracious, did a man get fresh with you?"

"Well, finally."

Professor in Geometry class: "Miss Smith, if I were to start at a given figure and travel the entire distance around, what would I get?"

Miss S: "You'd get your face slapped."



The JENSEN is yours!

We build no JENSEN Units for ourselves. We build them for you—to make your wells more profitable, more dependable, more satisfactory.

We have never authorized the sale of a JENSEN Unit to any producer in America unless we thought it was likely to be the best investment he could make. We have kept our record clean for 25 years.

So you can safely talk with Mr. Turner or The Oil Tool Corporation. They don't want your business unless they can help you.

California Representative

A. V. TURNER
445 W. 6th
Downey, Calif.
Phone: Topaz 2-2410

Stocked by

THE OIL TOOL CORPORATION
3075 Cherry Avenue
Long Beach, Calif.
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JENSEN

BROTHERS MFG. CO.
Coffeyville, Kansas, U.S.A.

EXPORT OFFICE: 50 Church St., New York City

Garrett Supply Company Appointed Local Distributors By Carboloy Company, Inc.

As a result of the tremendously increased demand on the West Coast for the spectacular new metal, Carboloy cemented carbides, and to provide faster deliveries and more comprehensive service to West Coast manufacturers, Garrett Supply Company, 3844 South Santa Fe, Los Angeles 11—for years leading specialists in precision cutting tools—has been appointed Carboloy distributor for Southern California and Arizona by K. R. Beardslee, Vice President in charge of sales for Carboloy Company, Inc., of Detroit, General Electric Subsidiary and the nation's leading producer of carbides and carbide cutting tools. This appointment supplements direct service operations of the Carboloy Company's branch at 5905 South Pacific Blvd., Los Angeles, which pioneered the use of carbides on the West Coast as far back as 1929 when Carboloy cemented carbide was first introduced.

According to Mr. Beardslee, cemented carbide, the hardest metal yet produced by man, has been in tremendous demand in the form of cutting tools employed in the machining of metal parts, particularly in the aircraft, shipbuilding, oil tool field and other war industries. It is estimated that approximately 50 per cent of all the metal removed in machining in industry at this time is being cut with tools tipped with cemented carbide.

Appointment of the Garrett Supply Company to handle Carboloy products means that carbide users in Southern California and Arizona will be able to obtain immediate delivery from larger West Coast stocks of such vital items as standard carbide tools; standard blanks for milling cutters, and reamers of many types; diamond-impregnated grinding wheel dressers; masonry drills, etc.

Garrett representatives, according to L. I. Williams, Vice-President of the company, have been especially trained in all the technical aspects of carbide tools by Carboloy engineers from Detroit. This assures an organization thoroughly grounded in the principles of tool design, brazing, grinding, and use as applied to cemented carbide cutting tools. In addition, two special Garrett carbide service engineers have been appointed to devote their full

K. R. Beardslee

time to assisting the users of Carboloy products in obtaining optimum performance from tools, etc.

Perhaps most unusual of the serv-

L. I. Williams

ices offered to Western industry by Garrett Supply is a Carboloy Training Course to be conducted with the cooperation of Carboloy Company West Coast representatives at Garrett Los Angeles headquarters. The course—available to key men responsible for carbide use in Southern California and Arizona plants—covers the fundamentals of modern carbide practice. In outlining the details of this training school, Mr. Williams stated that it will be essentially the same as the highly successful 5½ day course originally inaugurated at the Carboloy plant in Detroit and attended by many key men from West Coast industry. Various phases of good carbide practice are discussed, using slide films, followed up by practical demonstrations of brazing, grinding and individual instruction. Complete equipment to conduct this training program has already been installed. Realization of the importance of this subject to West Coast industry played a vital part in Garrett's decision to establish this training course. Garrett Supply is the first distributorship in the country to set up such a Carbide Training Course.

Mr. Williams further stated that in the application of carbide tools for greatly increased production and machining speeds, West Coast industries have done much pioneering work already. It has never been content, he said, with merely using "accepted" manufacturing practices, no matter how good they appear to be.

In this respect, Williams cited the contribution made by tool engineers in the aircraft industry on the West Coast who have successfully worked out methods for milling forgings, castings, and extruded parts—made from one of the most difficult of all aluminum alloys to machine—at speeds in excess of 12,000 surface feet per minute by the use of carbide tools. It was not very long ago that a few hundred feet per minute was considered a respectable speed for milling this same material, Williams pointed out. Mention was also made of the fact that tough alloy steel airplane parts—of spring-temper hardness—are now being machined with carbide tools at mass production rates eight or ten times higher than was attainable before the advent of carbide metal.

Contributions of this nature to high speed production already made by Coast factories could be multiplied indefinitely, Williams added.

Watson-Stillman Portable Hydraulic Pipe Bender

The construction of the machine is of the open jaw type permitting the pipe to be readily placed into and removed from the bender without having to remove any of the bending dies or formers. The pipe is at all times visible to the operator.

The bender consists of a hydraulic cylinder with built-in pumping unit mounted on a forged steel yoke with built-up welded frame. The cylinder and pump sub-assembly is shown above.

The plunger is made of forged steel actuated by the hydraulic pump and returned by spring return. This forged steel plunger operates in a cylinder of seamless steel tubing, and is in turn contained within a cistern also of seamless steel tubing.

The yoke is of forged steel and arranged with a yoke clip consisting of two stud bolts so that the full hydraulic cylinder and pumping unit can be removed from the bending frame.

The pump body is a forged steel block machined from the solid arranged with hand lever which actuates the pump by motion through 45° angle.

Weight of bender is approximately 180 pounds.

Of interest to the followers of the International Post War Reconstruction Program is the reopening of normal mail service between this country and Italy. Mr. N. M. Lawrence, Chief Engineer of Nobs Chemical Company of Los Angeles, reports that he received on Sept. 15 an air mail letter from Rome, written July 27 by an Italian petroleum engineer with whom he was associated in Albania prior to the outbreak of the war.

Western Pipe Issues New Catalog

Western Pipe and Steel Company of California has just issued a new up-to-date catalog covering Trumble oil and gas separators. This 16-page presentation covers oil and gas separation from the early days up to the present, is well illustrated and describes Trumble operational function. Illustrated are several types of valves automatic and manual operated as well as replacement parts with charts for valving and capacity requirements. Producers with oil and gas separation problems will find this treatise both interesting and useful. A copy is available and can be had by writing Western Pipe and Steel Company of California, Box 2015-F, Terminal Annex, Los Angeles 54, California.

Shell Company Establishes New Laboratory

The Shell Oil Company, Inc., in conjunction with the Shell Development Co., and the Shell Chemical Division of Shell Union Oil Corp. is scheduled to build a $599,000 agricultural laboratory at Salida, California. T. R. Hansberry of the New York State College of Agriculture has been named to head the technical staff. Among the projects to be studied are those dealing with the application of petroleum derivatives to agricultural problems.

Oronite Chemical Co. To Build New Plant

The Oronite Chemical Co., subsidiary of the Standard Oil Company of California, intends to build a $1,000,000 plant at Richmond, California, for the manufacture of phthalic anhydride. This synthetic chemical has many commercial uses, and enters into the manufacture of certain resins and lacquers.

The Ric-wiL Company Issues New Catalog

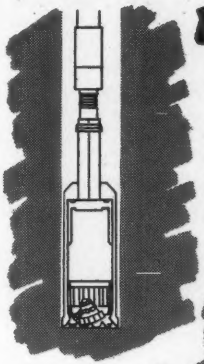
The Ric-wiL Company have just issued a new catalog No. 44, which gives comprehensive descriptions of all of the Ric-wiL products. The book contains many interesting and informative tables and specifications and anyone may obtain a copy by writing direct to The Ric-wiL Company, 1572 Union Commerce Bldg., Cleveland, Ohio.

3 Minutes on Bottom

—and the

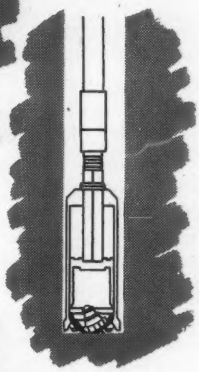
COOPER DIE-FORMED BASKET

has ALL the Junk!



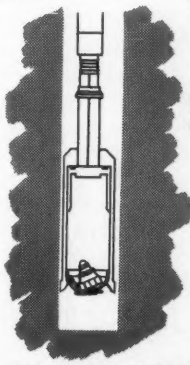
1 ON THE BOTTOM

The Cooper Die-Formed Basket, attached to the drill pipe by your own crew, is on the bottom, ready to work. No need to circulate, rotate or to make hole.



FINGERS MAKE BASKET 2

Weight applied to the drill string drives the steel fingers through the die, bending them into a tight basket.



3 ON THE WAY UP

As the fingers curve out and interlock, they scrape the bottom of the hole, picking up and retaining **all** the junk, big and little. A clean hole in 3 minutes!

GET A COOPER BASKET FROM

BAASH-ROSS TOOL CO.

LONG BEACH AVENAL — BAKERSFIELD LOS ANGELES

Manufactured by

ACME PATENT DEVELOPMENT CORP.
2680 Atlantic Ave., Long Beach, Calif.

Exclusive Domestic & Export Distributor

LIBERTY OIL TOOL CO.
P. O. Box 1548, Long Beach 1, Calif.

Jennings New Socony-Vacuum President

B. Brewster Jennings has been elected president of the Socony-Vacuum Oil Company, succeeding the late John A. Brown. Harold F. Sheets has been named chairman

B. B. Jennings

of the board of directors a post which has been unfilled since 1935.

Jennings was appointed assistant to the president in 1936, and was elected to the board of directors in 1937. He has had 24 years experience in different departments of the organization.

Petroleum Production Pioneers Hold Barbecue

150 members of the Petroleum Production Pioneers, new oil industry association, gathered at Standard of California's picnic grounds on the Murphy-Whittier property east of Whittier, Saturday night, September 23, 1944, for a barbecue and picnic.

Here, with gas flares furnishing the light and with the sound of old-fashioned pumping units in the background, old acquaintances were renewed and reminiscences related. A fine barbecue was served and the gang sang until far into the night to the accompaniment of an accordion.

Petroleum Production Pioneers, headed by H. S. Grinnell, comprises both veteran and younger men of the production, supply and purchasing branches of the industry in the Los Angeles Basin. Many thirty-year veterans, both active and retired, were present, with a generous sprinkling of the ten to thirty year men.

The object of the association, in addition to social events, is to compile a record of the achievements of the members individually, and of this branch of the industry as a whole, this data to be published as an historical monument.

University Southern California Offers Fall Term Courses in Petroleum and Gas Engineering

The War Training Office of the University of Southern California has announced Fall Term courses in subjects of interest to the petroleum industry. Classes are scheduled on pipe layout and drafting, cathodic protection, chemistry and technology of butadiene, oil field production methods, elements of refinery engineering, core analysis methods, and the fundamentals of instruments and equipment for industrial controls.

Application forms can be obtained at Room 251 Administration Bldg., 3551 University Ave., Los Angeles 7. Telephone RIchmond 4111 until 5 p.m. daily, or PRospect 9877 after 5 p.m.

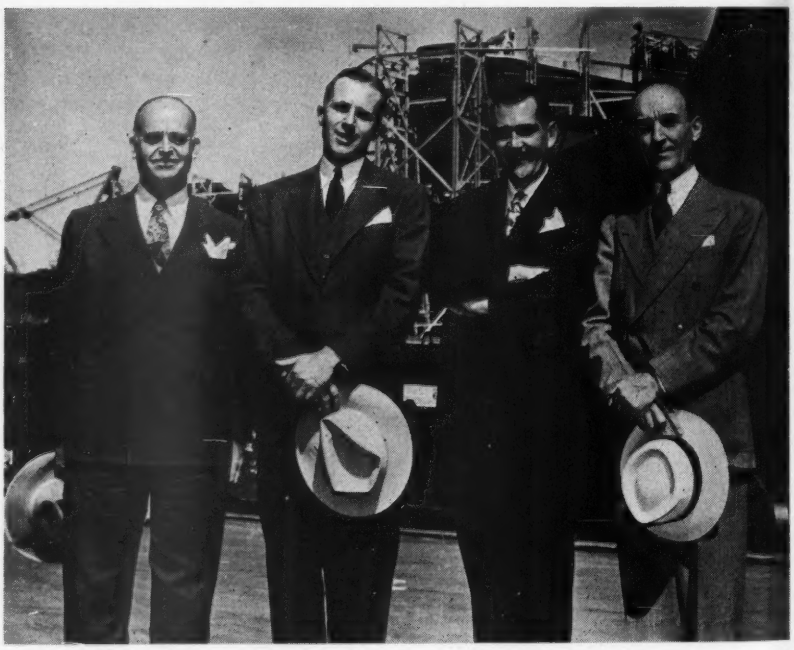
Fluor Issues New Bulletin

The Fluor Corp., Ltd., have just issued a new Aerator Cooling Tower Bulletin published in Spanish.

Copies of this bulletin may be had by anyone interested by writing to The Fluor Corp., Ltd., at P. O. Box 7030, East Los Angeles Station, Los Angeles 22, Calif.

Eastman Opens New District Office

The Eastman Oil Well Survey Company announces the opening of a District Office at 405 West First Street, Odessa, Texas. Mr. H. R. Benson, formerly resident engineer in Odessa, has been named District Superintendent for the West Texas area.

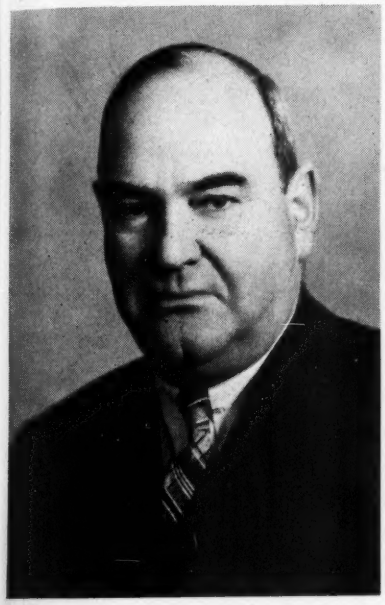


Representing the Shell Oil Company, Incorporated, and Kern County, at the launching of the Tanker SS Antelope Hills, at Marinship, shipyard at Sausalito on San Francisco Bay, Sunday, September 17th, at left to right: Gay Hoffman, Manager of the Kern County Chamber of Commerce; S. F. Bowlby, San Joaquin Division Production Manager of Shell; Daniel Wheelan of the oil company's advertising staff, and J. W. Watson, Assistant Secretary and Treasurer of Shell Chemical Division of Shell Union Oil Corporation. The vessel was named for an important oil field discovered and developed by the Shell Oil Company, Incorporated, fifteen miles northwest of McKittrick in Kern County, California. Shell brought the first well in the Antelope Hills field into production on May 11, 1942. Approximately 1,200,000 barrels of oil have already been drawn from this vital producing area.

George Zeh Retires

George Zeh, a nationally known figure in maritime circles and one of the most highly regarded men in the business has decided to call it a day and retire from active participation in marine affairs, it was learned recently.

Mr. Zeh's retirement date, falling on his 66th birthday, also marks ex-



George Zeh

actly the end of his 42nd year with Tide Water Associated Oil Company where he had been manager of the Marine Department for seventeen years.

Widely known in the American Petroleum Institute for his membership on a number of committees, George Zeh was also Director of the American Bureau of Shipping and Vice President of the Pacific American Tankship Association.

To wish him well and to pay tribute to the good fellowship they had enjoyed, a large group of his friends and associates in the Pacific American Tankship Association gathered recently at a ceremonial banquet in his honor. On this occasion Mr. Zeh was presented with a large, handsome nautical clock, and, as a further token of their esteem, a beautifully illustrated parchment inscribed with a testimonial message. The scroll was signed by William Anderson, Daniel Dobler, Joe Coney, Joe McEachern, Charlie Robertson, Al Kihn, Andy Nielson, John Stene, Arthur Woll, Farnham Griffiths, Harry Birkholm and Chet Ames.

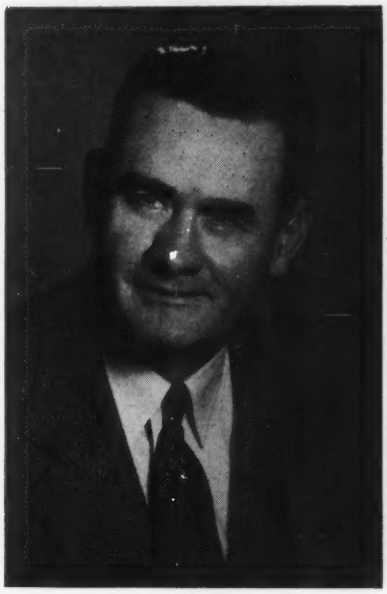
Tide Water Associated Oil Company associates also feted George Zeh before he left the company. More than fifty friends and coworkers tendered a luncheon in his honor at the Bohemian Club, San Francisco. Mr. H. B. Haney, Manager of Transportation, presided, and Mr. William F. Humphrey, President, made a talk expressing the appreciation of the company for Mr. Zeh's long and meritorious service. The group arranged to secure for George Zeh certain fine tools with which he can pursue his hobby of cabinet-making and inlay work at his home in Alameda, California.

John J. O'Keefe, Jr. With Bel-Air Oil Company

Because of expanded activities, Bel-Air Oil Company has increased its personnel and appointed John J. O'Keefe, Jr., assistant general manager. The company now has 15 producing wells with a production of 3000 bbl. per day in the Santa Maria area and has extensive acreage under lease in Santa Barbara and Ventur Counties, California, that in Santa Barbara County exceeding 5000 acres. It also has properties in Illinois.

Mr. O'Keefe was graduated with the degree of Mining Engineer from State College of Mines and Metallurgy, University of Texas, in 1921. Going immediately to Calfiornia, he first spent a year with the Southern California Gas Co. and Bureau of Power and Light, City of Los Angeles, and then entered the geological and petroleum Engineering Department of Petroleum Midway Co., now California Petroleum Corp. In 1925 he went with Miley Oil Co. as division petroleum engineer but after two years went into business for himself. In 1932 he became assistant to R. H. Garrison, consulting petroleum engineer, and in 1934 took a position as chief division petroleum engineer with Rio Grande Oil Co. and Richfield Oil Corp. He remained in that position, working in the Coast, Northern and Southern Divisions until his recent appointment as assistant general manager for Bel-Air Oil Company.

Bel-Air has locations staked for 43 additional wells on proven acreage and has two strings of tools operating with two full crews. Drilling operations are under the supervision of L. L. Kirchhof, assisted by Charles Meyers. Production superintendent is B. J. Mitchell. The company recently completed its well Tonascia No. 2 with a production of 800 bbl. per day, 17.80° A.P.I. oil cutting 0.4



John J. O'Keefe, Jr.

per cent, through a 32/64-in. choke with a casing pressure of 850 lb. per sq. in. and tubing pressure of 720 lb. per sq. in. Bel-Air Oil Co. is associated with Bell Oil and Refining Company which purchases most of its production. Jos. H. Gilliland is president of Bell Oil & Refining Co. and general manager of Bel-Air Oil Co.

PAW Studying Postwar Expansion of Refining

On the basis that the petroleum industry will expand and improve refineries after the war, the Petroleum Administration for War is making an attempt to gauge the extent of the postwar expansion.

Many refineries are believed ready to inaugurate construction and rehabilitation programs designed to improve gasoline and lubricating oils for civilian use. The PAW study of potential postwar needs in materials and supplies is expected to serve as a means of handling applications for materials when wartime needs are over.

W.P.B. Priorities Regulation 9 Amended

Deputy Petroleum Administrator Ralph K. Davies on Sept. 21st called attention to the simplified procedure for the procurement of materials and the export of those materials to foreign users engaged in petroleum industry activities.

Action was taken by the War Production Board, at the recommendation of the Petroleum Administration for War with the approval of the Foreign Economic Administration, as claimant agency for materials to be used in foreign countries. It was accomplished by amending WPB Priorities Regulation 9. The amendment becomes effective on September 21, 1944.

Discussing the action, Mr. Davies said:

"In general, PR 9 establishes a flexible system which can easily be adjusted and revised without the difficulty of frequent amendments as the materials situation improves. The amount of paper work to be performed by applicants and users of materials will be reduced considerably by this amendment.

"The new procedure closely parallels that recently established for the domestic industry through the amending of WPB's P-98-b."

Priorities Regulation 9, as amended, accomplishes the following:

1. Formally authorizes the use of a project form (Form WPB-3649.1) for construction with a material cost in excess of $10,000.

2. Authorizes the use of blanket preference ratings in obtaining material for maintenance and repair and for production operations provided the material is not listed on Schedule I of PR 9. This may be done by foreign petroleum operator as soon as they have received program letters from PAW. (These ratings place the foreign operators in parity with domestic operators. Program letters will serve much the same function to the foreign operators as PAO-11, PAO-12 and PAO-15 governing the domestic industry.)

3. Limits the use of blanket filing, as well as the limited filing under WPB-743, to materials for maintenance and repair purposes, operating supplies, materials for production operations, and materials for use in projects having a total material cost of $10,000 or less.

4. Requires the filing and specific approval of a pre-control form (Form WPB-743) to secure certain critical materials.

In connection with the simplification of procedures under which foreign operators obtain materials, the Foreign Economic Administration will modify the export license regulations to permit the use of WPB-743 for securing export clearance from FEA without the filing of additional bills of materials.

P. A. W. Reports on Gasoline Stocks

THE PETROLEUM ADMINISTRATION for WAR has warned that there is "barely sufficient" gasoline in stocks for civilians to take care of any "reasonable" fluctuations between demand and refinery production during the rest of 1944.

Deputy Petroleum Administrator Ralph K. Davies said that refinery production of civilian grade gasoline averaged 1,225,900 barrels daily for the first eight months of this year. A slight increase is recorded during the first two weeks of September when refinery production averaged 1,231,800 barrels daily. Demand for civilian gasoline at refineries and terminals in the United States during the last two weeks averaged 1,317,800 barrels daily, exceeding production by 86,000 barrels a day. "Demand for civilian gasoline during the last quarter of 1944 is estimated to average 1,223,000 barrels daily and refinery production of this product is estimated to be approximately 1,250,000 barrels daily," Mr. Davies said. "Heavy drafts on stocks should gradually diminish throughout the month of September and stocks will be built up to take care of the heavy farm demand during the spring of 1945."

In commenting on the present stock position, Petroleum Administrator Harold L. Ickes said, "Only about one-half of our total gasoline stocks in the United States are civilian grade gasoline. The other half consists of unfiinished gasoline, aviation and special military grades, butadiene, toluene, solvents, and naphthas. Total gasoline stocks in the United States were 78,372,000 barrels on September 23, as compared with 79,963,000 barrels for the same time in 1941 when almost 90 percent of the total were civilian grades."

P. A. W. stated that total stocks of civilian grade motor gasoline at refineries and terminals in the United States were 40,111,000 barrels on September 16, compared with 40,898,000 barrels the previous week. District V (Pacific Coast) stocks of civilian products were as follows: Civilian grade gasoline totaled 3,21,000 barrels on September 16, compared with 3,717,000 barrels on September 9; kerosene, 413,000 barrels compared with 424,000; distillate (home heating) fuel oil,, 10,822,000 barrels compared with 10,546,000; residual (industrial) fuel oil, 28,342,000 barrels compared with 27,994,000; and crude oil, 28,148,000 barrels on September 16 compared with 27,519,000 barrels on September 9.

Priority Rules for Station Repair Materials Eased

Deputy Administrator Ralph K. Davies has announced that upon the recommendation of the P. A. W., the War Production Board has amended Direction 2 to Preference Ration Order P-8-b, permitting all filling stations to use an AA-3 preference rating to obtain maintenance and repair materials, instead of AA-5. The old AA-5 rating must still be used, however, to obtain operating supplies. Under the amendment, a petroleum operator will use an AA-3 rating to obtain a maximum of $100 worth of material needed to install or replace filling-station type gasoline pumps or petroleum storage tanks of more than 65-gallon capacity. It was pointed out that the AA-3 rating may be used only for materials necessary to make the installations and not for the pumps or tanks.

Secondary Recovery

(Continued from Page 16)

tion of improved completion practices. All past experience and the results of these practices emphasize the importance of selective completion of wells in secondary-recovery operations for larger ultimate oil production from our present and future developed reserves.

(Courtesy Tomorrow's Tools Today published by Lane-Wells Co.)